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Sampling and Analysis Plan
Tyco Thermal Controls, LLC
2201 Bay Road
Redwood City, California

Prepared for:
Tyco Thermal Controls, LLC, Redwood City, California

Prepared by:
AMEC Geomatrix, Inc., Oakland, California

February 2011

Project 0124420010.00014

AMEC Geomatrix

February 18, 2011

Project 0124420010.00014

Ms. Carmen D. Santos
RCRA Corrective Action Office
Waste Management Division
U.S. Environmental Protection Agency Region 9
75 Hawthorne Street
San Francisco, California 94105

Subject: Response to U.S. Environmental Protection Agency Conditional Approval of the PCB Cleanup Notification and Work Plan
Tyco Thermal Controls. LLC
2201 Bay Road, Redwood City, California

Dear Ms. Santos:

On behalf of Tyco Thermal Controls, Inc., AMEC Geomatrix, Inc. (AMEC), is submitting the enclosed Sampling and Analysis Plan (SAP) for the site located at 2201 Bay Road, Redwood City, California. This SAP was prepared as requested by the United States Environmental Protection Agency (U.S. EPA) in the January 4, 2011 conditional approval of the PCB Cleanup Notification and Work Plan (dated June 14, 2011) and addendum (dated October 5, 2010).

The SAP was prepared to fulfill Conditions 2 through 10 of the Conditional Approval. Condition 6 was fulfilled with Tyco Thermal Control's January 6, 2011 letter confirming the removal plan for concrete and asphalt. The remaining conditions are addressed as follows:

- Conditions 1 and 12 – Restrictive Covenant, if required, will be recorded within 120 days after the PCB Cleanup Report has been approved by the U.S. EPA.
- Condition 11 – A subsurface physical barrier will be installed as part of the proposed soil remediation activities to separate site soil at the north boundary of the site from potentially PCB-contaminated soil at the adjacent property. Prior to the placement of imported fill materials described in Section 5.11.5 of the PCB Cleanup Notification and Work Plan, a nonwoven geotextile fabric will be placed on the north excavation sidewall from the bottom of the excavation to within six inches of ground surface. When fill has been placed to within six inches of ground surface, at least six inches of fabric will be folded southward towards the site before the final fill lift is placed.
- Condition 13 – PCB Cleanup Report will be prepared consistent with 40 CFR 761.125(c) (5) and submitted to U.S. EPA within 60 days after completion of the cleanup verification sampling.

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If you have any questions, please contact the undersigned at (510) 663-4100.

Sincerely yours,
AMEC Geomatrix, Inc.

Peggy Peischl

Margaret K. (Peggy) Peischl, PE
Senior Engineer

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Enclosure

cc: David Barr, California Regional Water Quality Control Board
Joseph L. Schohn, Tyco International
Mark Smith, Tyco Thermal Controls, LLC
Spence Leslie, Tyco Thermal Controls, LLC
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Tyco Thermal Controls, LLC
2201 Bay Road
Redwood City, California

1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) was prepared by AMEC Geomatrix, Inc. (AMEC) on behalf of Tyco Thermal Controls, LLC (TTC) for the site located at 2201 Bay Road in Redwood City, California (the site; see Figure 1). The proposed remediation for polychlorinated biphenyl (PCB) compounds in soil was presented to the United States Environmental Protection Agency (U.S. EPA) Region 9 in the June 14, 2010 PCB Cleanup Notification and Work Plan (Cleanup Work Plan; AMEC, 2010c); and an Addendum to the Cleanup Work Plan was submitted on October 5, 2010 (AMEC, 2010d). This SAP has been prepared as requested by the U.S. EPA in its January 4, 2011 Conditional Approval letter (referred to hereafter as the "Conditional Approval"; U.S. EPA, 2011).

1.1 REGULATORY FRAMEWORK

1.1.1 Regulatory Agencies

The U. S. EPA provides regulatory oversight of PCB remediation activities under the Toxic Substances Control Act (TSCA).[1] In addition, the California Regional Water Quality Control Board, San Francisco Bay Region (Water Board) provides regulatory oversight under the relevant sections of California statutes.

1.1.2 PCB Cleanup Notification and Work Plan

Although U. S. EPA has primary jurisdiction over PCB cleanups such as the cleanup at the site, the proposed remediation for PCB compounds in soil was presented to and approved by the Water Board in a Remedial Design/Remedial Action Work Plan (RD/RA Work Plan; AMEC, 2009f). The RD/RA Work Plan was prepared in accordance with the federal National Oil and Hazardous Substances Pollution Control Plan (NCP; U.S. EPA, 1990), Remedial Design/Remedial Action Handbook (U.S. EPA, 1995b), and the Guidance for Scoping the Remedial Design (U.S. EPA, 1995a). At the time the FS was prepared, soil to be remediated was identified on the north/west side of the property. The proposed soil remediation addressed soil from ground surface to depths ranging from 2 to 8 feet below ground surface (bgs) containing PCB, total petroleum hydrocarbons quantified as diesel (TPHd), and volatile organic compound (VOC) concentrations above their respective site remediation goals. The

[1] 40 CFR 761.61(a) or (c).

proposed remediation area, based on existing data in 2008, is shown as the area north of and outside of the building footprint on Figure 3 (Areas 1A, 1B, 2B, and portions of 2A and 2C). (The remediation area shown on Figure 3 now includes additional areas under the building based on the results of the January 2010 Sub-Slab Soil Investigation; see Section 3.1.3.) (AMEC, 2010a). The proposed work consists of excavating soil containing concentrations of constituents in excess of site cleanup goals, stockpiling the soil on site, sampling and analyzing the stockpiled soil for characterization purposes,[2] transporting the soil to an appropriate, permitted landfill according to the characterization data, and backfilling the excavation with clean, imported soil. The implementation details are included in Section 5.0.

On May 11, 2010, representatives of TTC, the Water Board, and U.S. EPA Region 9 met to discuss site remediation and the "self-implemented" cleanup approach under 40 CFR 761.61(a). TTC and the Water Board presented the site background, history, investigation details, and remedial approach in the approved RD/RA Work Plan. The U.S. EPA stated that it would not approve a self-implemented cleanup approach for the site at that time and requested that TTC provide the following:

1. Propose additional chemical analyses to address PCB degradation products;
2. Address the impact on the site cleanup of PCBs in soil on the railroad right-of-way offsite and adjacent to the northern boundary of the Site;
3. Determine (1) if sufficient samples have been collected to characterize constituents of potential concern (COPCs) in soil beneath the building footprint, (2) if sufficient locations within the building footprint were sampled for COPCs, (3) whether the process for post excavation soil characterization was adequate, and (4) the appropriate approach to sample PCBs in the concrete slab for waste characterization; and
4. Provide additional information to meet the requirements of 40 CFR 761.61(a) (self-implementing) or (c) (risk based), in order for U. S. EPA to designate the appropriate program, based on these requirements.

The June 14, 2010 Cleanup Work Plan was prepared in accordance with TSCA and to respond to the U.S. EPA's requests. TTC met with representatives of the Water Board and the U.S. EPA on June 15, 2010 to present the primary elements of the plan. During the meeting, U.S. EPA requested certification letters from AMEC and TTC and clarification and modifications to the proposed soil and concrete sampling approaches. An addendum to the Cleanup Work Plan (AMEC, 2010d) was submitted to the U.S. EPA on October 5, 2010, which consisted of a revised soil sampling program (Appendix D of the Cleanup Work Plan) and the

[2] Soil with PCBs will be transported and disposed as bulk PCB remediation waste in accordance with 40 CFR 761.61. If required by the disposal facility, additional soil stockpile sampling and chemical analyses may be performed.

concrete sampling approach (Appendix E of the Work Plan), as well as required certification letters.

1.1.3 Conditions for Approval

The PCB remediation activities, were proposed by AMEC on behalf of TTC in the Cleanup Work Plan and addendum and conditionally approved by the U. S. EPA in its January 4, 2011 Conditional Approval letter (referred to hereafter as the "Conditional Approval"; U.S. EPA, 2011). This Conditional Approval was under a combination of 40 CFR 761.61(a) and (c). This SAP was prepared to fulfill Conditions 2 through 10 of the Conditional Approval (Appendix A). Conditions to be addressed outside of this SAP include the following:

1. Conditions 1 and 12 – Restrictive Covenant, if required, will be recorded within 120 days after the PCB Cleanup Report has been approved by the U.S. EPA.
2. Condition 6 – Removal plan for concrete/asphalt was confirmed in the January 6, 2011 letter from TTC to U.S. EPA.
3. Condition 11 – Propose the type of subsurface barrier to be installed along the north boundary of the site.
4. Condition 13 – PCB Cleanup Report will be prepared consistent with 40 CFR 761.125(c) (5) and submitted to U.S. EPA within 60 days after completion of the cleanup verification sampling.

1.2 OBJECTIVES

This SAP was prepared in accordance with the U.S. EPA's April 2000 Sampling and Analysis Plan Guidance and Template, Version 2 guidance document (U.S. EPA, 2000). The objectives of this SAP are to present the sampling and analysis procedures for the collection of:

1. Pre-excavation confirmation soil samples to delineate PCBs to the site cleanup level (0.74 milligrams per kilogram [mg/kg]) in the vicinity of three proposed on-site excavations;
2. Systematic soil samples to assess the presence of PCBs in the central and southeastern portions of the site;
3. Concrete samples across the concrete slab at the site to assist in waste characterization of the concrete floor following its demolition; and
4. Post-excavation cleanup verification soil samples.

1.3 SITE NAME

As discussed above, the site is referred to as the Tyco Thermal Controls site located at 2201 Bay Road in Redwood City, California.

1.4 SITE LOCATION

The site is located in Redwood City, which is in the southern portion of the San Francisco peninsula, along the margins of San Francisco Bay. The site is located in a mixed industrial-use area (Figures 1 and 2). The site is bordered on the south by Bay Road and on the east by Charter Street. The curved north and west boundary of the site is bordered by former railroad alignments and private property.

1.5 RESPONSIBLE AGENT

AMEC and its subcontractors will conduct the work proposed in this SAP on behalf of TTC. The local AMEC office is located in Oakland, California.

1.6 PROJECT ORGANIZATION

The project organization for work described herein is presented below.

Title/Responsibility	Name	Phone Number
EPA Project Manager	Carmen D. Santos	(415) 972-3360
Water Board Case Manager	David Barr	(510) 322-2313
TTC Project Manager	Mark Burriss	(650) 474-7975
AMEC Staff		
Principal in Charge	Gary Foote, PG	(510) 663-4260
Project Manager	Margaret K. (Peggy) Peischl, PE	(510) 663-4226
Quality Assurance Manager	Tiffany Klitzke	(510) 663-4144
Health and Safety Manager	Donald Kubik, Jr., CIH, PG	(510) 663-4115

1.7 STATEMENT OF THE SPECIFIC PROBLEM

Based on previous environmental investigations, PCBs are present in on-site soil and the concrete slab. To achieve the remediation goals presented in the Cleanup Work Plan, soil excavation, primarily along the northwest property boundary, was the selected remedial alternative to address PCBs in soil. In addition, the existing building will be demolished, and PCBs in the concrete slab properly characterized and disposed of.

2.0 BACKGROUND

This section provides a description of the site, the known operational history of the site, and the known environmental impacts.

2.1 SITE DESCRIPTION

The site is owned by TTC and is currently vacant. The site has an asphaltic concrete-paved parking lot, approximately 71,600 square feet of building space, and an unpaved roadway behind a portion of the building. Former railroad alignments are located along the northern boundary of the site. Historical operations have consisted of electronic wire manufacturing, transformer manufacturing, and other manufacturing. Under TTC ownership, the most recent site use included office space, storage, and electronics assembly and packaging. The site vicinity is shown on Figure 1, and a site plan is shown on Figure 2.

2.2 OPERATIONAL HISTORY

The site has been used for industrial purposes since development in 1955 (Earth Tech, 2004). The initial facility consisted of 22,000 square feet of office and warehouse space and an outdoor loading ramp and platform. Additional building space was constructed in 1956, 1963, 1965, and 1974. A second loading ramp also was constructed in 1963. As discussed above, the current total building square footage is approximately 71,600.

Based on a review of available data, historical operations have included electronic wire manufacturing, transformer manufacturing, and other manufacturing. According to the Phase I Environmental Site Assessment, open transformers and a water tank were located at "the southwest end of the building" on a 1962 Sanborn map, and transformer oil was stored in two above ground storage tanks (ASTs; Earth Tech, 2004). The ASTs were reportedly installed in the northeast portion of the property in 1968 and were removed in 1974 when a laboratory was constructed at that location. Historical occupancy is reported as follows[3] (Earth Tech, 2004):

1955	Sequoia Process Corporation
1968	Hill-Magnetics, Inc.
1973	Raychem Corporation
1999	Tyco Electronics (purchased Raychem Corporation)

2.3 PREVIOUS INVESTIGATIONS AND ENVIRONMENTAL IMPACT

Previous investigations have been conducted at the site to evaluate the nature and extent of detected COPCs in soil, groundwater, and soil vapor. Soil and groundwater samples were collected in 1999, 2005, 2008, and 2009 and 2010; and soil gas samples were collected in 2005. Investigations were conducted within the building footprint and the unpaved area outside and north of the building. Although limited sampling has been conducted in the parking lot areas, these areas were historically only used for parking. A summary of the historical data is

[3] Occupancy dates may be approximate.

What is meant by systematic?

included in Appendix B. Brief descriptions of the previous soil and groundwater sampling programs are described in the following subsections.

2.3.1 Historical Soil Sampling Programs

This section presents an overview of the previous soil sampling programs for PCBs at the site. Analytical results for soil samples analyzed for PCBs in each investigation are presented in Appendix B and historical sampling locations are shown on Figure 2.

In 1999, soil samples were predominately collected from locations along the northwestern portion of the site near a loading dock adjacent to the building. In 2005, the sampling program from 1999 was augmented by collecting soil samples below the footprint of the building in an area of the building along the northwestern portion of the Site. A sample grid was used to systematically select sample locations; some of which were adjusted to address site features, such as cracks or patches in the concrete floor, that were indicative of possible pathways to sub-surface soil.

During the 1999 and 2005 site investigations, 62 soil samples were collected from 32 borings to a maximum depth of 8 feet bgs (the approximate depth to groundwater). Typical sample depths for individual borings were 0 and 2 feet bgs; 0, 2, and 6 feet bgs; or 0, 1, 2, and 8 feet bgs. The sample depths are included in the summary tables in Appendix B.

In June 2008, an additional 53 soil samples were collected from 14 borings and analyzed for PCBs in soil in three areas of the Site outside of the building footprint: a) near the loading ramp and platform where elevated concentrations of PCBs were detected, but the vertical extent was not defined; b) near the former ASTs; and c) an area where a former water tank was reportedly located inside the building.

Because there is no history of operations or knowledge where PCBs were used in the building, an additional 291 sub-slab soil samples were collected from 73 soil borings and analyzed for PCBs in January 2010. The 2010 investigation was also designed to define the lateral and vertical extent of PCBs near the northwestern edge of the building footprint. The sample locations near the northwestern edge of the building footprint were placed on a systematic, triangular grid based on 15-foot spacing (Figure 2). For the rest of the building, soil samples were placed on a systematic square grid based on approximate 60-foot spacing and then adjusted target site features.

In summary, a total of 406 soil samples from 119 separate soil borings advanced to depths up to 8 feet bgs have been collected outside and from within the building footprint using elements of both an authoritative and systematic sampling approach. Most of the boring locations were initially selected based on a systematic sampling approach. However, sample locations were adjusted from the initial grid locations to target site features, such as cracks or patches observed in the concrete slab. For the January 2010 investigation, the sampling locations were adjusted in cooperation with a Water Board representative who was present when the adjustments were made. As discussed above, Appendix B presents a summary of soil samples collected at the site and analyzed for PCBs.

2.3.2 Historical Groundwater Monitoring Programs

Five groundwater monitoring wells were installed in March 2008 to assess conditions in groundwater. A Groundwater Monitoring Work Plan (AMEC, 2008a) was approved by the Water Board (Water Board, 2008), and quarterly groundwater monitoring was conducted in November 2008; February, May, and August 2009 (AMEC, 2009a,b,c,d,e). An updated Groundwater Monitoring Work Plan (GWMP) was prepared for the RD/RA Work Plan. Quarterly groundwater monitoring resumed in February 2010 (AMEC, 2010b) and was completed in November 2010 (AMEC, 2011). The purpose of the 2010 groundwater monitoring program for the site was to monitor groundwater conditions for four consecutive quarters and evaluate groundwater elevations, gradients, and dissolved concentrations of VOCs in site groundwater. The results of groundwater monitoring conducted between April 2008 and November 2010, indicate the following:

- Groundwater elevations have shown limited seasonal variation and consistently indicate a northern flow direction, which is consistent with regional flow towards San Francisco Bay.
- The calculated groundwater gradients have been stable at the site.
- The VOC concentrations in groundwater from onsite wells are either decreasing or stable.
- A regional chlorinated solvent plume was confirmed within the vicinity of the site that may be contributing to the onsite concentrations.

The Water Board-approved GWMP was completed in November 2010, and no additional groundwater monitoring is proposed for the site at this time. The soil excavation and building demolition activities described in the RD/RA Work Plan and the PCB Notification are scheduled to occur in 2011. In preparation for that work, the monitoring wells at the site were destroyed in December 2010 to prevent the groundwater monitoring wells from interfering with the planned demolition and remediation work.

2.3.3 Summary of Site Conditions

The results of previous site investigations and monitoring programs indicate that COPCs were detected in shallow soil and groundwater at the site, as follows:

- Shallow Soil: VOCs, TPHd, and PCBs detected in soil at concentrations exceeding risk management levels have been detected in an area in the northern portion of the site, near the former railroad spur and loading dock (outside of the building footprint). PCBs were also detected at concentrations exceeding risk management levels in soil beneath the slab of the existing building footprint. The investigation results indicate that VOC, TPHd, and PCB concentrations generally decrease with depth.

- Groundwater: The most recent groundwater sampling event was conducted in November 2010, and samples were analyzed for VOCs. The analytical results indicate that only one VOC (PCE) was detected in groundwater at concentrations exceeding the Water Board Environmental Screening Level (ESL; 5.0 microgram per liter [µg/L]) (Water Board, 2008a). PCE was detected in groundwater in upgradient and side-gradient monitoring wells; however, it appears that the site is also located in a regional PCE plume (AMEC, 2010b). Dissolved metals, total petroleum hydrocarbon (TPH), semivolatile organic compounds (SVOCs), and PCBs were analyzed in groundwater during previous sampling events. Dissolved metals detected in groundwater were well below their respective ESLs. TPHd, TPH quantified in the motor oil range (TPHmo), SVOCs, and PCBs were not detected in groundwater from any of the monitoring wells at concentrations greater than their respective laboratory reporting limits.[4]

3.0 PROJECT DATA QUALITY OBJECTIVES

Data Quality Objectives (DQOs) are qualitative and quantitative statements for establishing criteria for data quality and for developing data collection designs. Data collected on a site need to be of sufficient quality and quantity to support defensible decision making. DQOs ascertain the type, quality, and quantity of data necessary to address the problem before sampling and analysis begin.

3.1 PROJECT TASK AND PROBLEM DEFINITION

The following project task and problem definitions are presented for the four objectives presented in Section 1.2:

1. Delineate PCBs to the site cleanup levels in the vicinity of three proposed on-site excavations.

2. Assess the presence of PCBs in shallow soil in the central and southeastern portion of the site.

[4] Grab groundwater samples were collected in 2005 from open boreholes, and the samples were not filtered in the field or prior to analysis. PCBs detected in grab groundwater samples from locations ET1 and ET9 were likely not representative of groundwater conditions as the samples likely included sediment or fines. See Section 4.3 for proposed soil sampling at these two locations.

3. Characterize PCBs in the concrete floor.

4. Following soil excavation, assess the presence of PCBs in the excavation sidewalls and bottoms. Ten percent (10%) of the verification soil samples will be analyzed for dioxin-like PCB congeners.

3.2 Data Quality Objectives (DQOs)

The following DQOs are presented for the respective objectives of the SAP:

1. If PCBs are detected in pre-excavation shallow soil samples at concentrations above the site cleanup level (0.74 mg/kg) along the proposed excavation boundaries, the excavation boundaries will be expanded. If PCBs are not detected in shallow soil at concentrations above the site cleanup level along the proposed excavation boundaries, the proposed excavation boundaries will not be expanded.

2. If PCBs are detected in shallow soil samples beneath the concrete floor above the site cleanup level (0.74 mg/kg), an additional excavation area will be proposed surrounding the location of the site cleanup goal exceedance. If PCBs are not detected above the site cleanup level, no excavation will be proposed at that location.

3. If PCBs are detected in concrete above the hazardous landfill acceptance criterion (50 mg/kg), the concrete will be disposed at a hazardous waste landfill. If PCBs are detected below the non-hazardous landfill acceptance criterion, the concrete potentially will be disposed at a non-hazardous landfill.

4. If PCBs are detected in post-excavation confirmation soil samples at concentrations above the site cleanup level (0.74 mg/kg) along the proposed excavation sidewalls or bottoms, the excavation boundaries will be expanded by 1 foot in the direction of the PCB exceedance. If PCBs are not detected above the site cleanup level in the excavation confirmation samples, the excavation boundaries will not be expanded.

rethink this number ok.

3.3 Data Quality Indicators (DQIs)

DQIs refer to quality control guidelines established for various aspects of data gathering, sampling, and analysis. The quality control guidelines are expressed in terms of precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS). The following subsections present a summary of each PARCCS parameter and calculation equations, as appropriate. The DQIs, type of quality control sample, frequency requirement, and related quality assurance and quality control (QA/QC) guidelines are presented in Table 1.

3.3.1 Precision

Precision is a measurement of the degree of agreement of replicate data, which is quantitatively assessed based on the relative percent difference or standard deviation.

3.3.1.1 *Field Precision*

Because of the heterogeneity of soil and concrete samples, field precision cannot easily be assessed using field duplicates. Therefore, no field duplicates will be collected. Results of matrix spike/matrix spike duplicates and the laboratory control samples/laboratory control sample duplicates may be evaluated to determine whether an apparent difference between field duplicates is significant.

3.3.1.2 *Laboratory Precision*

Laboratory precision is assessed by calculating RPDs for duplicate samples. The precision of the analysis can be inferred through one of the following: laboratory control samples (LCS) and laboratory control sample duplicates (LCSD); matrix spike (MS) and matrix spike duplicate (MSD) samples, or unspiked duplicate samples. The laboratory will analyze one or more of these duplicate samples at a rate of approximately one per laboratory batch of 20 samples per sampling event. check

The precision of laboratory analyses will be assessed by calculating the RPD for each pair of matrix spike duplicate samples (MS/MSD), laboratory control sample duplicates (LCS/LCSD), unspiked duplicate samples, and field duplicate samples using the following equation:

$$\% RPD = \frac{S_1 - S_2}{S_{av}} \times 100$$

where:

S1 = first sample result (original value)
S2 = second sample result (duplicate value)
Sav = average of sample and duplicate = (S1 + S2)/2

3.3.2 Accuracy

Accuracy is the degree of agreement between a measurement or observation and an actual value.

3.3.2.1 *Field Accuracy*

Field accuracy, assessed through appropriate equipment rinsate samples is achieved by adhering to sampling equipment decontamination procedures and sample handling, preservation, storage, shipment, and holding time requirements. Trip blanks are used to assess the potential for contamination of samples due to migration of volatile contaminants during sample handling, storage, and/or shipment. Equipment rinsate samples are used to assess the adequacy of decontamination of sampling equipment between collection of samples. Field blank samples are used to evaluate the quality of the water used to generate the equipment rinsate samples and to assess potential atmospheric contamination. The frequency of field QC samples is listed in Table 2. The accuracy of field instruments is assessed by instrument calibration and calibration checks.

3.3.2.2 Laboratory Accuracy

Laboratory accuracy is assessed by analyzing matrix spikes and LCS. The results are expressed as a percent recovery. Surrogate recoveries may also be used to assess accuracy. Method blanks are used to assess possible contamination from laboratory procedures. Matrix spikes, laboratory control samples, and method blanks will be analyzed at least once with each laboratory batch of 20 samples per sampling event. The percent recovery (% R) is calculated using the following equation:

check 8082A Method.

$$\% R = \frac{A - B}{C} \times 100$$

where:

A = The analyte concentration determined experimentally from the spiked sample
B = The background concentration determined by a separate analysis of the unspiked sample
C = The concentration of the spike added

3.3.3 Representativeness

Representativeness is a qualitative measure of the degree to which sample data accurately and precisely represent a characteristic environmental condition. Representativeness is a subjective parameter used to evaluate the efficacy of the sampling plan design. Representativeness is demonstrated in this SAP by providing descriptions of the sampling techniques and the rationale used for selecting sampling locations. The measure of representativeness is established during preparation of the sampling and analysis approach and rationale, and then reassessed during the data usability process. Numerical goals cannot be used to evaluate this subjective measure.

3.3.4 Completeness

Completeness is a measure of the quantity of valid data obtained from a measurement system compared to the quantity that was planned under normal conditions. Percent completeness is calculated with the following equation:

$$\% Completeness = \frac{ValidDataObtained}{TotalDataPlanned} \times 100$$

Experience on similar projects has shown that a reasonable goal, considering combined historical field and laboratory performance, is 90 percent completeness. If sufficient valid data are not obtained, corrective action will be initiated by the Project Manager or QA/QC Officer.

3.3.5 Comparability

Comparability expresses the confidence with which one data set can be compared with another data set obtained during parallel or previous investigations. Comparability can be related to precision and accuracy because these parameters are measures of data reliability.

Chemical samples from the same media generally are considered comparable if similar procedures for collecting and analyzing the samples are used, if the sampling and analysis comply with the similar QA/QC guidelines, and if the units of measurement are the same. To provide comparability, data generated will be subject to the QA/QC procedures specified in this SAP.

3.3.6 Sensitivity

Sensitivity is the measure of the concentration at which an analytical method can positively identify and report analytical results. The sensitivity of a given method commonly is referred to as the detection limit or analytical laboratory reporting limit. Although there is no single definition of these terms, the following terms and definitions will be used as appropriate.

1. Instrument detection limit (IDL) is the minimum concentration that can be measured as distinct from instrument background noise under ideal conditions.

2. Method detection limit (MDL) is a statistically determined concentration. It is the minimum concentration of an analyte that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero as determined in the same or a similar matrix. Because of the lack of analytical precision in this range, sample results greater than the MDL but less than the analytical laboratory reporting limit (RL) may be presented as "ND" (not detected) or "<RL" (less than reporting limit), indicating that the compound was not detected at or above the specific analytical laboratory RL.

3. Analytical laboratory RL is the concentration of the target analyte that the laboratory has demonstrated the ability to measure within specified limits of precision and accuracy during routine laboratory operating conditions. This value is variable and highly matrix dependent. It is the minimum concentration that the laboratory will report as unqualified.

For sensitivity, the quality objective is to analyze data using methods that achieve RLs that meet the project specific goals. The RLs for the SAP are presented in Table 3. These RLs will be used to evaluate the sensitivity of the site monitoring data collected. These "limits" are more accurately described as goals, because actual reporting limits cannot be guaranteed due to sample matrix properties, interference from other compounds present, and analytical instrument calibration variability.

3.4 DATA VALIDATION AND USABILITY

This section describes the QA/QC activities that will occur after the data collection phase of the project is completed. Implementation of this section will determine whether or not the data conform to the specified criteria, thus satisfying the project objectives.

3.4.1 Data Review and Validation

Data validation is the process of reviewing data and accepting, qualifying, or rejecting data on the basis of sound criteria. Project personnel will validate field data by reviewing it to identify inconsistencies or anomalous values. The data validation approach for laboratory data will consist of a systematic review of the primary and QC sample analytical results. Best professional judgment in any area not specifically addressed by U.S. EPA guidelines will be utilized as necessary. Data will be validated according to applicable guidelines set forth in the U.S. EPA's Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (OSWER 9240.1-48, U.S. EPA-540-R-08-01) dated June 2008 (U.S. EPA, 2008b). Data validation will include a data completeness check of each data package and a thorough review of laboratory reporting forms. Specifically, this review will include:

- review of data package completeness;
- review of sample holding times;
- review of duplicate, blank, surrogate, and spike sample results;
- review of laboratory analytical reporting limits relative to the site monitoring program reporting limits (Table 3);
- calculation and review of field duplicate relative percent differences;
- review of the laboratory reporting forms to evaluate whether the laboratory QC requirements were met and to determine the effect of exceeded QC requirements on the precision, accuracy, and sensitivity of the data; and
- application of standard data quality qualifiers to the data.

3.4.2 Data Usability

The usability assessment will provide an overall summary of data quality, including acceptability of, or problems with, the precision, accuracy, representativeness, completeness, comparability, and sensitivity of the results with guidance to the data users on the uncertainties in the data that have been qualified. Because of cumulative effects of QC exceedances, some specific results may be determined to be unusable. Alternatively, based on the U.S. EPA guidelines and best professional judgment, specific results may be determined to be usable even when they are outside the QC criteria.

3.5 ASSESSMENT OVERSIGHT

A summary of assessment activities that will be conducted for the anticipated work include:

- Assessment of field operations: To evaluate field operations performance, frequent review of sample collection documentation, chain-of-custody (COC) forms, and field notes and measurements.

- Assessment of laboratory operations: Torrent has a program of internal audits that are performed to assess the degree of adherence to their own policies and procedures. Additionally, the Project Manager and Task Leaders will be in frequent contact with the analytical laboratory to assess progress in meeting DQOs and to identify problems requiring corrective action.

The following subsections identify the planned assessment and oversight activities to assure the objectives identified above are attained for field and laboratory operations. The Project QA Manager and/or the Project Manager may also identify additional assessment activities to be performed during the course of the project based upon findings of the planned assessment activities described below.

3.5.1 Assessment of Field Operations

In general, internal assessments of field operations will be conducted by the Project QA Manager and/or other designated members of the project team where appropriate. The assessment activities will evaluate field operations performance issues such as:

- Are sampling operations being conducted in accordance with the respective Cleanup Work Plan and SAP?

- Are the sample labels being filled out completely and accurately?

- Are the COC records complete and accurate? field notes, documenting field activities / chain of custody forms

- ? Are the field records being filled out completely and accurately?

- Are the sampling activities being conducted in accordance with the approved Work Plan?

The results of any assessment activities will be reported to the Project Manager by the team member conducting the assessment activity. Assessment activity reports will include the findings and identification of any corrective actions taken or planned.

3.5.2 Assessment of Laboratory Operations

The laboratory has an ongoing internal audit program that has been implemented to monitor the degree of adherence to its own policies, procedures, and standards. The internal audit program is described in Torrent's Quality Assurance Manual and includes systems audits, performance evaluations, data audits, and spot assessments. Internal audits are conducted by laboratory personnel who are independent of the area(s) being evaluated. The laboratory also participates in external audits conducted by regulatory agencies and other clients. Project-specific assessments of laboratory operations are described below.

Will this also be done [illegible]

The Project Manager and/or QC Officer will be in contact with the analytical laboratory on a regular basis while samples collected during this investigation are being analyzed. This will allow assessment of progress in meeting DQOs and the identification of any problems requiring corrective actions early in the investigative process. The Project Manager or QC Officer will be responsible for working directly with the laboratory to assure the prompt resolution of any problems identified.

3.6 DATA MANAGEMENT

Data collected during the implementation of the Cleanup Work Plan will consist of analytical data from soil and concrete samples and field measurements for sample locations and excavation dimensions. These data will be used to update the site conceptual model, document cleanup activities, and characterize concrete for off-site disposal.

what about data validation by 3rd party

3.6.1 Data Recording

Observations made and measurements taken in the field are recorded on appropriate data sheets or in field records. Upon completion of the field work, the pertinent data will be entered into a spreadsheet and tabulated for evaluation and presentation in the PCB Cleanup Report. The written records will be maintained in the project files.

3.6.2 Data Verification

Data verification is an integral part of the QA program and consists of reviewing and assessing the quality of data. Data verification provides assurance that the data are of acceptable quality as reported. For validity, the characteristics of importance are precision, accuracy, representativeness, comparability, and completeness. Data usability is the determination of whether or not a data set is sufficiently complete and of sufficient quality to support a decision or action, in terms of the specific DQOs.

The data verification process will include:

- Evaluating against blank criteria—laboratory blanks;

This will also need to encompass review of raw data such as chromatograms, instrument calibration

- Evaluating against accuracy criteria—holding times, surrogates, laboratory control samples, and matrix spikes;

- Evaluating against precision criteria—matrix spikes/matrix spike duplicates, and field and laboratory duplicates; and

- Confirming that data qualifiers are assigned appropriately.

will need a QA chemist to do this, not an engineer.

(initial + continuing + acceptability of calibrations) and method used to quantify the PCBs as Aroclors. (pattern recognition + peaks used in quantitation)

3.6.3 Data Transmittal

The integration of field data is completed by inputting the data from field forms into a spreadsheet format by data entry personnel. The spreadsheet is reviewed for completeness and accuracy by a staff geologist or engineer by comparing the electronic spreadsheet to the original field data.

3.6.4 Data Tracking

The Project Manager is responsible for all activities conducted as part of the groundwater sampling program including data management. The Project Manager has the authority to enforce proper procedures as outlined in this plan and to implement corrective procedures to assure the accurate and timely flow and transfer of data. The Project Manager will review the final data reports.

Soil descriptions will be generated during drilling. The generators of data will be responsible for accurate and complete documentation of data required under the task, and for assuring that these data are presented to their supervisor in a timely manner.

The Field Task Leader (FTL) will be responsible for the day-to-day monitoring of data collected in the field. He/she assures that data are collected in the format specified in the task's work plan, assigns sample designations, and routes data to the project files. At least one copy of all project documents will be retained by the FTL for project use during the investigation. Original documents will be maintained in the project file.

The Project Manager will be responsible for the day-to-day monitoring of activities related to the generation and reporting of chemical data and ensures that samples are analyzed according to the specified procedures; that data are verified; the data are properly coded, and checked for accuracy; and the data are routed to the project files.

4.0 SAMPLING RATIONALE

The following sections describe the sampling rationale for the work proposed in this SAP.

8082A or latest
4.1 PRE-EXCAVATION SOIL SAMPLING

Ten soil borings (Borings B-89 through B-98) will be advanced and soil samples will be collected to delineate PCB concentrations in the vicinity of three proposed on-site excavations (Excavations 2A, 2C, and 3A). Four soil samples will be collected from each soil boring, for a total of 40 samples, and analyzed for PCBs using U.S. EPA Method 8082 following extraction using U.S. EPA Method 3550C (ultrasonic extraction method). The soil sampling and analysis program summary is included as Table 4.

Want Soxhlet.

4.2 SYSTEMATIC SOIL SAMPLING

The PCB Work Plan presented an evaluation of existing soil data to determine if sufficient samples have been collected to characterize COPCs that may be detected in soil beneath the building footprint based on U.S. EPA recommendations and guidelines. The evaluation indicated that the spacing between sample locations for the previous soil investigations was not consistent throughout the building footprint, and additional soil samples are proposed at 12 locations (Borings B-99 through B-110) to supplement the existing data. The proposed boring locations are shown on Figure 3. Up to four soil samples will be collected from each soil boring, for a total of up to 44 samples, and analyzed for PCBs by Method 8082 following extraction using U.S. EPA Method 3550C (ultrasonic extraction method). The soil sampling and analysis program summary is included as Table 4. Soil samples will be collected following the procedures described in Section 6.3.

what is rationale for sample intervals
0.5 ft
1.5 ft
4.5 ft
6.0 ft

The results of the concrete sampling program described in Section 4.2 may be used to supplement the proposed soil sampling program.

Why not a 0-½" sample for all concrete interfaces

During the removal of the concrete slab, the underlying soil will be observed for evidence of staining or odors; and, based on these observations, additional soil sampling may be proposed to evaluate soil conditions. As required in Condition 5.d, the additional site characterization samples will be collected if odors, stained, oily, and/or discolored soil are observed during the removal concrete, asphalt, and/or asphaltic concrete pavement from other areas at the site. If sampling is required, the sampling and analytical requirements will be confirmed with the U.S. EPA.

4.3 ADDITIONAL SOIL ASSESSMENT SAMPLING

As requested by the U.S. EPA in their Conditional Approval of the Cleanup Work Plan (Condition 5), one soil boring (boring B-111) will be advanced at approximately the same location as the 2005 grab groundwater sampling location ETB-1. Four soil samples will be collected from boring B-111, for a total of 8 samples, and analyzed for PCBs using U.S. EPA Method 8082 following extraction using U.S. EPA Method 3550C (ultrasonic extraction method). The soil sampling and analysis program summary is included as Table 4. Soil samples will be collected following the procedures described in Section 6.3. Additional soil samples will not be collected at the location of historical boring ETB-9 because soil is adequately characterized in this area and the soil at the location of historical boring ETB-9 will be removed as part of the remediation activities.

4.4 CONCRETE SAMPLING

As described above, PCBs have been detected in soil beneath the building. Therefore, PCBs may be detected in the concrete flooring at the site. As described in 40 CFR Part 761, Subpart N (Section 761.265 for porous surfaces;) and Subpart O (Sections 761.283 and 761.286), concrete flooring must be characterized for PCBs in-situ prior to demolition and waste disposal. This section is prepared consistent with Subparts N and O.

All characterizing must be discrete spls.

27 ft x 27 ft.

A 9-meter-by-9-meter Cartesian grid was overlain across the building footprint (Figure 4). Each column was labeled with a letter and each row was labeled with a numeral. At each node of the sampling grid, concrete samples will be collected. Eighty concrete samples will be collected and analyzed for PCBs using U.S. EPA Method 8082 following extraction using U.S. EPA Method 3550C (ultrasonic extraction method). The concrete sampling and analysis program summary is included as Table 5. Concrete samples will be collected following the procedures described in Section 6.4.

What is size of Bldg footprint

4.5 POST-EXCAVATION VERIFICATION SOIL SAMPLING

Post-excavation verification soil sampling will be conducted pursuant to 40 CFR Part 761, Subpart O. A 5-feet-by-5-feet (approximately 1.5-meter-by-1.5-meter) Cartesian grid spacing was overlain on each proposed excavation with on grid axis parallel to the long axis of the building (northeast-southwest) as shown on Figures 5 through 8. At the center of each grid cell an excavation bottom sample will be collected and where the north-south grid lines intersect the excavation sidewall, an excavation sidewall sample will be collected. It should be noted that as described in Section 5.11.2 of the Cleanup Work Plan, the property boundary sidewalls of proposed Excavations 1B and 2B will be shored; therefore, sidewall samples will not be collected along the property boundary sidewalls.

How will it be confirmed no PCBs are present on Tyco side of excavation sidewalls at Exc. 1B and 2B.

Samples will be composited in the laboratory pursuant to 40 CFR Part 761.289; samples will be composited at a rate of up to 9 discrete samples per composite. Composite samples (estimated to be 121 samples) will be collected and analyzed for PCBs using U.S. EPA Method 8082 following extraction using U.S. EPA Method 3550C (ultrasonic extraction method). A subset of samples (approximately 10%) will be analyzed for dioxin-like PCB congeners using U.S. EPA Method 1668B. The post-excavation verification soil sampling and analysis program summary is included in Table 6. Soil samples will be collected following the procedures described in Section 6.3.

What Contaminated concrete? Want to see analysis via 1668C also.

5.0 REQUEST FOR ANALYSIS

As shown on Tables 4 through 6, 206 soil and 80 concrete samples will be collected. All samples will be extracted using U.S. EPA Method 3550C and analyzed for PCBs using U.S. EPA Method 8082. Approximately 10% of the cleanup verification samples will be analyzed for dioxin-like PCB congeners using U.S. EPA Method 1668B. Additional concrete flooring samples may be collected and analyzed as requested by the potential waste disposal facilities.

5.1 ANALYTICAL LABORATORY

All samples will be transported to Curtis & Tompkins, Ltd. of Berkeley, California, (C&T) under COC protocols. Samples for PCB U.S. EPA Method 8082 analysis and sample compositing will be performed by C&T. C&T's quality assurance (QA) manual is included in Appendix C. Samples for dioxin-like PCB congeners U.S. EPA Method ~~1668B~~ 1668C analysis will be analyzed by C&T's subcontracted lab, Frontier Analytical Laboratory of El Dorado Hills, California (FAL). C&T will send select samples for U.S. EPA Method 1668B analysis to FAL under COC protocols. FAL's QA manual is included in Appendix D. In addition, C&T's and FAL's standard operating procedures (SOPs) for the following procedures and analyses included in the Appendices of this report:

- PCB sample extraction using U.S. EPA Method 3550C (ultrasonic extraction) (Appendix E)
- PCB sample analysis using U.S. EPA Method 8082 (Appendix F)
- Dioxin-like PCB congeners extraction using U.S. EPA Method ~~1668B~~ 1668C (Appendix G) Update G
- Dioxin-like PCB congeners analysis using U.S. EPA Method ~~1668B~~ 1668C (Appendix H) Update H
- Sampling compositing (Appendix I)

6.0 FIELD METHODS AND PROCEDURES

This section describes the field methods and procedures to be used by AMEC to collect the soil and concrete samples discussed above. It should be noted that all sample collection activities will be performed in accordance with Section 7.0 below.

6.1 FIELD EQUIPMENT

This section describes the field equipment needed to perform the soil and concrete soil sampling activities. To perform the soil sampling activities, the following will be used:

- Direct-push drill rig fitted with a dual-tube soil sampler will be used to collect continuous soil cores.

- An impact hammer drill with a 1-inch-diameter, carbide drill bit in accordance with U.S. EPA, Region 1's Standard Operating Procedure for Sampling Porous Surfaces for PCBs dated May 9, 2008 (U.S. EPA, 2008a) will be used to collect concrete samples. Send plan SOP.

- Sampling trowel.

- Photoionization detector (PID) for air monitoring purposes and to screen soil for organic vapors.

The only piece of equipment that will require calibration is the PID. The PID will be fitted with a 10.6 electron-volt ultraviolet lamp and will be calibrated daily using 100 parts per million isobutylene gas. The PID will be calibrated daily, the calibration will be recorded in AMEC's daily field records, and the daily field records will be kept on file at AMEC's Oakland's office.

6.2 FIELD SCREENING

Soil retrieved during sampling activities will be screened every foot using a PID by: (1) placing soil into sealed plastic bags; (2) letting the soil equilibrate within each plastic bag for at least 5 minutes; and (3) inserting the PID intake into the plastic bag and recording a reading. PID readings will be recorded on all soil boring logs or daily field records.

6.3 PRE-EXCAVATION CONFIRMATION, SYSTEMATIC, AND ADDITIONAL ASSESSMENT SOIL SAMPLING

A drilling permit will be obtained from San Mateo Environmental Health Services Division (SMEHSD) and a California-licensed drilling contractor will perform drilling activities. Soil samples will be targeted for collection for laboratory analysis at depth intervals shown in Table 4. However, based on sample recovery from the drilling activities, sample intervals may vary. As discussed above, a direct-push drill rig fitted with a dual-tube sampler will be used to collect a continuous soil core from each boring location. The SOP for the dual-tube soil sampler to be used (Geoprobe® DT325 model) is included as Appendix J. Lithologic descriptions of the soil will be recorded on boring logs by a trained field geologist under the supervision of a California Professional Geologist using visual-manual procedures of the American Society for Testing and Materials (ASTM) Standard D2488-09a for guidance, which is based on the Unified Soil Classification System (USCS). Soil samples will be collected by cutting the butyrate soil core liner at the desired 6-inch interval. The bottom of the interval will correspond with the indicated sampling depths in Table 4. The cut butyrate liner sample will then be sealed at each end with Teflon™ sheets, plastic end caps, and silicon tape. Upon completion of the borings, each borehole was grouted from total depth to ground surface with Type I-II neat cement grout using a section of polyvinyl chloride (PVC) tremie pipe per the requirements of the SMEHSD.

Samples at 0-3" concrete/soil interface should be collected

![amec logo]

6.4 CONCRETE SAMPLING

Concrete sampling activities will be performed in accordance with U.S. EPA, Region 1's Standard Operating Procedure for Sampling Porous Surfaces for PCBs dated May 9, 2008 (U.S. EPA, 2008a). To perform the concrete sampling activities, an impact hammer drill with a 1-inch-diameter carbide drill bit will be utilized to pulverize in place concrete from the concrete floor surface to 0.5 inch below the top of the concrete floor. It is anticipated that each in-place 1-inch-diameter concrete core to 0.5 inches will yield approximately 10 grams of pulverized concrete. The analytical laboratory requires approximately 35 grams of sample to extract and analyze a sample for PCBs; therefore, at least four 1-inch-diameter, 0.5-inch-deep holes will be drilled to obtain the minimum sample mass. A scoop or spoon will be used to remove the pulverized concrete and place it into the laboratory-provided, clean glass jars. Concrete samples will be collected for laboratory analysis as shown in Table 5.

change to revised SOP & provide SOP send it to them

6.5 POST-EXCAVATION VERIFICATION SOIL SAMPLING

Some excavations will be sufficiently deep to not allow sampling personnel access. Therefore, each discrete soil sampling location will be sampled by using a decontaminated trowel to scoop soil from either directly from the excavation sidewall or bottom in shallow excavations or from a bucket of soil retrieved from the desired sampling location by the excavator at deeper excavations.

potential dilution of PCBs. Need check other approach to collect samples that will minimize dilution.

6.6 DECONTAMINATION PROCEDURES

All equipment that comes into contact with potentially contaminated soil or concrete will be decontaminated. Disposable equipment intended for one-time use will not be decontaminated, but will be packaged for appropriate disposal. Decontamination will occur prior to and after each use of a piece of equipment. All sampling equipment including drill rods, cutting shoes, and concrete coring and/or drills bits will be decontaminated in accordance with 40 CFR 761.79(c)(2)(i). Therefore, decontamination procedures will consist of:

R1 The SOP has its own decon procedure

Need keep records dilution figures by decon fluid disposal

1. First Wash: Rinse and scrub using Alconox™ or equivalent non-phosphate detergent solution to remove visible soil or dust.

2. Second Wash: Rinse and scrub using organic solvent. Wipe all organic solvent (hexane or equivalent) off surfaces to remove potentially-present residual PCBs.

3. Third Wash: Rinse and scrub using Alconox™ or equivalent non-phosphate detergent solution to remove residual organic solvent.

4. Fourth Wash: Rinse using tap water.

check reg to ensure procedure is equivalent.

5. Fifth Wash: Rinse using distilled water.

Equipment will be decontaminated in a predesignated area on plastic sheeting. Five buckets (one for each wash above) will be prepared with the designated cleaning agents. Clean equipment will be stored on plastic sheeting in an uncontaminated area and covered if it is stored for more than a few hours.

7.0 SAMPLE CONTAINERS, PRESERVATION AND STORAGE

This section describes the sample containers, preservation, and storage for the samples to be collected under this SAP.

7.1 PRE-EXCAVATION CONFIRMATION, SYSTEMATIC, AND ADDITIONAL ASSESSMENT SOIL SAMPLES

For pre-excavation confirmation, systematic, and additional assessment soil samples, which will all be collected using a drill rig as described in Section 6.3, the cut butyrate liner sample will then be sealed at each end with Teflon™ sheets, plastic end caps, silicone tape, labeled, and placed in sealable plastic bags. Samples will be stored in an-ice chilled cooler for preservation purposes.

7.2 CONCRETE SAMPLES

Concrete samples will be collected in laboratory-provided, clean 8 ounce glass jars. Sample jars will be placed in sealable plastic bags, labeled, and stored in an-ice chilled cooler for preservation purposes.

7.3 POST-EXCAVATION CLEANUP VERIFICATION SOIL SAMPLES

Post-excavation cleanup verification soil samples will be collected in laboratory-provided, clean 8 ounce glass jars. Sample jars will be placed in sealable plastic bags, labeled, and stored in an-ice chilled cooler for preservation purposes.

8.0 DISPOSAL OF RESIDUAL MATERIALS

In the process of collecting environmental samples at the site during the above-described investigation, the AMEC sampling team will generate different types of potentially-contaminated investigation-derived waste (IDW) that include the following:

- Used personal protective equipment (PPE)
- Disposable sampling equipment
- Decontamination fluids

Not what was proposed
→ follow 761.61(c)

follow 761.79(g)

review against 61(a) disposal requirements

Separate container

- Soil cuttings from soil borings
- Concrete debris generated during concrete sampling

Used PPE and disposable equipment will be double bagged and placed in a municipal refuse dumpster. Decontamination fluids, soil cuttings, and concrete debris generated during soil and concrete sampling will be containerized in U.S Department of Transportation (DOT)-approved 55-gallon drums in a predetermined area. The drums will be labeled with "Pending Analysis" labels and will list contact information for the generator (TTC) and the AMEC project manager and the contents. Samples will be collected from the drums and analyzed for PCBs using U.S. EPA Method 8082. Additional analyses may be requested based on the requirements of the off-site disposal facility. Following receipt of the analytical data, the drums will be profiled by the off-site disposal facility, labeled with the waste classification, and transported to the disposal facility under the appropriate manifest (non-hazardous or hazardous).

No dilution

9.0 SAMPLE DOCUMENTATION AND SHIPMENT

This section describes the procedures that AMEC will use to document the field effort and to ship the sample to the analytical laboratory.

9.1 FIELD NOTES

Field notes will be recorded on an AMEC Daily Field Record (DFR; Appendix K). The following items will be recorded each day on a DFR:

- Sample location and description
- Site or sampling area sketch showing sample location and measured distances
- Sampler's name(s)
- Date and time of sample collection
- Designation of sample as composite or grab
- Type of sample (soil or concrete)
- Type of sampling equipment used
- Field instrument readings and calibration
- Field observations and details related to analysis or integrity of samples (e.g., weather conditions, noticeable odors, colors, etc.)
- Sample preservation

- Lot numbers of the sample containers, sample identification numbers and any explanatory codes, and COC form numbers
- Shipping arrangements (courier pickup by laboratory)
- Name of recipient laboratory
- Team members and their responsibilities
- Time of arrival/entry on site and time of site departure
- Other personnel on site
- Summary of any meetings or discussions with contractors, state or federal agency personnel, or the public
- Deviations from sampling plans or site safety plans

Should agency notify of deviation before the implementation

- Changes in personnel and responsibilities with reasons for the changes
- Levels of safety protection
- Calibration readings for any equipment used and equipment model and serial number

9.2 PHOTOGRAPHS

Photographs will be taken at the sampling locations and at other areas of interest on site or sampling area. They will serve to verify information entered in the DFRs. For each photograph taken, the following information will be written in the logbook or recorded in a separate field photography log:

- Time, date, location, and weather conditions
- Description of the subject photographed
- Direction of photograph
- Name of person taking the photograph

9.3 LABELING

All samples collected will be labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory. The samples will be preassigned, identifiable, and unique numbers as shown on Tables 4 through 6. At a minimum, the sample labels will contain the following information: station location, date of collection, analytical parameter(s), and method of preservation.

9.4 SAMPLE CHAIN-OF-CUSTODY FORMS AND CUSTODY SEALS

COC records report forms are used to document sample collection and shipment to laboratories for analysis. All sample shipments for analyses will be accompanied by a COC record. A copy of the form is found in Appendix L. COCs will be completed and sent with the samples for each laboratory and each shipment. If multiple coolers are sent to the laboratory on a single day, forms will be completed and sent with the samples for each cooler.

The COC form will identify the contents of each shipment and maintain the custodial integrity of the samples. Generally, a sample is considered to be in someone's custody if it is either in someone's physical possession, in someone's view, locked up, or kept in a secured area that is restricted to authorized personnel. Until the samples are shipped, the custody of the samples will be the responsibility of AMEC. The sampling team leader or designee will sign the COC form in the "relinquished by" box and note date, and time.

The sample numbers for all rinsate samples, reference samples, laboratory QC samples, and duplicates will be documented on this form (see Section 10.0). The bottom copy will be kept in AMEC's project files.

The shipping containers in which samples are stored (usually a sturdy picnic cooler or ice chest) will be sealed with self-adhesive custody seals any time they are not in someone's possession or view before shipping. All custody seals will be signed and dated.

9.5 PACKAGING AND SHIPMENT

All sample containers will be placed in a strong-outside shipping container, such as a cooler. The following outlines the packaging procedures that will be followed for low-concentration samples.

1. When ice is used, pack it in zip-locked, plastic bags. Seal the drain plug of the cooler with tape to prevent melting ice from leaking out of the cooler.
2. The bottom of the cooler should be lined with bubble wrap to prevent breakage during shipment.
3. Secure bottle/container tops with clear tape and custody seal all container tops.
4. Affix self-adhesive sample labels onto the containers.
5. Wrap all glass sample containers in bubble wrap to prevent breakage.
6. Seal all sample containers in heavy duty plastic zip-lock bags.
7. Place samples in a sturdy cooler. Enclose the appropriate COC in a zip-lock plastic bag affixed to the underside of the cooler lid.

8. Fill empty space in the cooler with bubble wrap or Styrofoam peanuts to prevent movement and breakage during shipment.

9. Ice used to cool samples will be double sealed in two zip lock plastic bags and placed on top and around the samples to chill them to the correct temperature.

10. Custody seals will be affixed to the front, right of each cooler.

10.0 QUALITY CONTROL

This section presents the QA/QC program for the proposed work, including descriptions of the QC requirements for the field work, DQIs, and data validation and usability assessment. The results of the QA/QC program will be summarized in the required technical reports following the sampling event.

The laboratory analytical methods were presented in Section 5.0. The laboratory personnel will review results of the method-specific laboratory QC samples against the QA/QC guidelines, and corrective action, if required, will be taken in accordance with the laboratories' internal QA/QC program (as described in the QA Manuals in Appendices C and D).

10.1 FIELD QUALITY CONTROL SAMPLES

Need to add dupl samp

Field QC samples will be used to assess the quality of the sampling and analysis process and matrix-specific method performance. Field QC samples for soil will include equipment rinsate samples and MS/MSD samples. The field QC sample program is summarized in Table 2 and discussed below.

10.1.1 Assessment of Field Contamination (Blanks)

Field contamination is usually assessed through the collection of different types of blanks. They provide the best overall means of assessing contamination arising from the equipment, ambient conditions, sample containers, transit, and the laboratory.

As part of this SAP, during soil sampling, equipment blanks will be collected each by passing distilled water through a dual-tube soil sampler with a new, disposable butyrate soil liner with a decontaminated soil cutting shoe. During concrete sampling, equipment blanks will be collected by pouring distilled water over the decontaminated drill bit used to collect concrete samples. One equipment blank for each type of sampling (soil or concrete) will be collected per sampling day.

For each cooler that is shipped or transported to an analytical laboratory a 40 mL volatile organic analysis (VOA) vial will be included that is marked "temperature blank." This blank will be used by the sample custodian to check the temperature of samples upon receipt.

amec

10.1.2 Assessment of Field Variability (Field Duplicates)

Duplicate soil and concrete samples are not proposed for the field work to be conducted under the Cleanup Work Plan because of sample heterogeneity

check on this. May have to collect

10.2 LABORATORY QUALITY CONTROL SAMPLES

A routinely collected soil sample (a full 8-ounce sample jar) contains sufficient volume for both routine sample analysis and additional laboratory QC analyses. Therefore, a separate soil sample for laboratory QC purposes will not be collected.

10 samples are required in 8082A

At a minimum, one laboratory QC sample is required per 14 days or one per 20 samples (including blanks and duplicates), whichever is greater. If the sample event lasts longer than 14 days or involves collection of more than 20 samples per matrix, additional QC samples will be designated.

check with lab

11.0 FIELD VARIANCES

As conditions in the field may vary, it may become necessary to implement minor modifications to sampling as presented in this SAP. When appropriate, the QA Office will be notified and a verbal approval will be obtained before implementing the changes. Modifications to the approved plan will be documented in the PCB Cleanup Report.

Must notify EPA of any changes to the approved plan, if possible prior to implementing the changes

12.0 FIELD HEALTH AND SAFETY PROCEDURES

AMEC will develop a site-specific health and safety plan (HSP) for the field activities described in this SAP. The HSP will describe safety equipment and clothing that may be required, explanation of potential hazards that may be encountered, and location and route to the nearest hospital or medical treatment facility. A copy of the HSP will be kept on-site during the field activities.

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TABLES

check these against 8082A criteria

TABLE 1

DATA QUALTITY INDICATORS AND QA/QC GUIDELINES

Tyco Thermal Controls
2201 Bay Road
Redwood, California

Method Performance Objective	Type of Quality Control Sample	Frequency	QA/QC Guidelines
Precision—Field	Field duplicate	None needed	Not applicable to soil — Need!
Precision—Laboratory	LCS and LCSD	1 per laboratory batch of 20 samples	Per laboratory criteria
	MS and MSD	1 per laboratory batch of 20 samples	RPD <30%
	Unspiked duplicate	1 per laboratory batch of 20 samples	RPD <30%
Accuracy—Field	Trip blank	Not applicable to non-volatile constituents such as PCBs	U.S. EPA National Functional Guidelines Protocol
	Equipment rinsate	1 per sampling day per type of sampling (soil or concrete)	U.S. EPA National Functional Guidelines Protocol
	Field blank	1 per water source per sampling event	U.S. EPA National Functional Guidelines Protocol
Accuracy—Laboratory	MS	1 per laboratory batch of 20 samples per matrix	Percent recovery within compound specific limits (per laboratory and/or analytical method requirements)
	LCS	1 per laboratory batch of 20 samples per matrix	Percent recovery within compound specific limits (per laboratory and/or analytical method requirements)
	Method blank	1 per laboratory batch of 20 samples per matrix	No compounds should be detected in laboratory method blanks

TABLE 1

DATA QUALTITY INDICATORS AND QA/QC GUIDELINES

Tyco Thermal Controls
2201 Bay Road
Redwood, California

Method Performance Objective	Type of Quality Control Sample	Frequency	QA/QC Guidelines
Accuracy—Laboratory (cont'd)	Surrogate	Per analytical method requirements	Percent recovery within compound specific limits (per laboratory and/or analytical method requirements)
Representativeness	Not applicable	Not applicable	Numerical goals cannot be used to evaluate this subjective measure
Completeness	Not applicable	Not applicable	90% completeness
Comparability	Not applicable	Not applicable	Comparable if similar procedures for collecting and analyzing the samples are used, if the samples comply with similar QA/QC criteria, and if the units of measurement are the same
Sensitivity	Not applicable	Not applicable	RLs below or equal to the cleanup goal

Abbreviations:
- LCS = laboratory control sample
- LCSD = laboratory control sample duplicate
- MS = matrix spike
- MSD = matrix spike duplicate
- QA/QC = quality assurance/quality control
- RLs = Reporting limits
- RPD = relative percent difference
- U.S. EPA = United States Environmental Protection Agency

TABLE 2

FIELD QUALITY CONTROL SAMPLES

Tyco Thermal Controls
2201 Bay Road
Redwood City, California

Type of QC Sample	Frequency	QA/QC Guidelines
Equipment Rinsate Sample	1 per sampling day	EPA National Functional Guidelines Protocol
Field blank Soil,	1 per water source per sampling event	EPA National Functional Guidelines Protocol

[illegible] sampling water.

TABLE 3

ANALYTICAL METHODS, REPORTING LIMIT GOALS, AND SAMPLE CONTAINERS

Tyco Thermal Controls
2201 Bay Road
Redwood City, California

Target Analytes	EPA Extraction Method	EPA Analyitcal Method	Reporting Limit Goal [1]	Site Soil and Concrete Cleanup Level [2] (mg/kg)	Sample Container and Preservative
PCBs	3550C [3]	8082 [3]	0.012 and 0.024 mg/kg	0.74	**Soil:** 6-inch-long butyrate liner or stainless steel tube placed in an ice-chilled cooler **Concrete:** plastic bag in an ice-chilled cooler
Dioxin-like PCB Congeners	1668B [4]	1668B [4]	1.0 pg/g	NA	**Soil:** 6-inch-long butyrate liner or stainless steel tube placed in an ice-chilled cooler

Notes

1. Reporting limits cannot be guaranteed due to sample matrix properties, interference from other compounds present, and analytical instrument limitations. The reporting limit goal for all PCB congeners is 0.012 mg/kg with the exception of Aroclor-1221, which has a reporting limit goal of 0.024 mg/kg.
2. U.S. EPA-approved site soil cleanup level for PCBs is 0.74 mg/kg per the January 4, 2011 Conditional Approval letter to TTC.
3. U.S. EPA Methods are taken from *Test Methods for Evaluating Solid Waste*, U.S. EPA-SW-846, Update III, December 1996.
4. U.S. EPA Methods are taken from *Method 1668B, Chlorinated Biphenyl Congeners in Water, Soil, Sediment, Biosolids, and Tissue by HRGC/HRMS*, U.S. EPA-821-R-08-020, November 2008.

Abbreviations

U.S. EPA = United States Environmental Protection Agency
mg/kg = milligrams per kilogram
NA = not available
pg/g = picograms per gram
PCBs = polychlorinated biphenyls

1668C

should this be PCB Aroclors?

check previous data

Add 0 to 3 inches below concrete slab

0.5
4.5
8.0

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TABLE 4

SOIL SAMPLING AND ANALYSIS PROGRAM SUMMARY [1]

Tyco Thermal Controls
2201 Bay Road
Redwood City, California

Sampling Location [1]	Rationale	Sample Depths (feet btof)	Sample Name	PCBs
Proposed Excavation 2A				
B-89	Delineation of PCBs in the vicinity of proposed Excavation 2A	0.5 [2]	B-89-0.5	X
		1.5	B-89-1.5	X
		4.5	B-89-4.5	X
		8.0 [3]	B-89-8.0	X
B-90	Delineation of PCBs in the vicinity of proposed Excavation 2A	0.5 [2]	B-90-0.5	X
		1.5	B-90-1.5	X
		4.5	B-90-4.5	X
		8.0 [3]	B-90-8.0	X
B-91	Delineation of PCBs in the vicinity of proposed Excavation 2A	0.5 [2]	B-91-0.5	X
		1.5	B-91-1.5	X
		4.5	B-91-4.5	X
		8.0 [3]	B-91-8.0	X
B-92	Delineation of PCBs in the vicinity of proposed Excavation 2A	0.5 [2]	B-92-0.5	X
		1.5	B-92-1.5	X
		4.5	B-92-4.5	X
		8.0 [3]	B-92-8.0	X
Proposed Excavation 2C				
B-93	Delineation of PCBs in the vicinity of proposed Excavation 2C	0.5 [2]	B-93-0.5	X
		1.5	B-93-1.5	X
		4.5	B-93-4.5	X
		8.0 [3]	B-93-8.0	X
B-94	Delineation of PCBs in the vicinity of proposed Excavation 2C	0.5 [2]	B-94-0.5	X
		1.5	B-94-1.5	X
		4.5	B-94-4.5	X
		8.0 [3]	B-94-8.0	X
Proposed Excavation 3A				
B-95	Delineation of PCBs in the vicinity of proposed Excavation 2A	0.5 [2]	B-95-0.5	X
		1.5	B-95-1.5	X
		4.5	B-95-4.5	X
		8.0 [3]	B-95-8.0	X
B-96	Delineation of PCBs in the vicinity of proposed Excavation 2A	0.5 [2]	B-96-0.5	X
		1.5	B-96-1.5	X
		4.5	B-96-4.5	X
		8.0 [3]	B-96-8.0	X
B-97	Delineation of PCBs in the vicinity of proposed Excavation 2A	0.5 [2]	B-97-0.5	X
		1.5	B-97-1.5	X
		4.5	B-97-4.5	X
		8.0 [3]	B-97-8.0	X

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TABLE 4

SOIL SAMPLING AND ANALYSIS PROGRAM SUMMARY [1]

Tyco Thermal Controls
2201 Bay Road
Redwood City, California

?

Sampling Location [1]	Rationale	Sample Depths (feet btof)	Sample Name	PCBs
B-98	Delineation of PCBs in the vicinity of proposed Excavation 2A	0.5 [2]	B-98-0.5	X
		1.5	B-98-1.5	X
		4.5	B-98-4.5	X
		8.0 [3]	B-98-8.0	X
Systematic Sampling				
B-99	Additional systematic soil samples	0.5 [2]	B-99-0.5	X
		1.5	B-99-1.5	X
		4.5	B-99-4.5	X
		8.0 [3]	B-99-8.0	X
B-100	Additional systematic soil samples	0.5 [2]	B-100-0.5	X
		1.5	B-100-1.5	X
		4.5	B-100-4.5	X
		8.0 [3]	B-100-8.0	X
B-101	Additional systematic soil samples	0.5 [2]	B-101-0.5	X
		1.5	B-101-1.5	X
		4.5	B-101-4.5	X
		8.0 [3]	B-101-8.0	X
B-102	Additional systematic soil samples	0.5 [2]	B-102-0.5	X
		1.5	B-102-1.5	X
		4.5	B-102-4.5	X
		8.0 [3]	B-102-8.0	X
B-103	Additional systematic soil samples	0.5 [2]	B-103-0.5	X
		1.5	B-103-1.5	X
		4.5	B-103-4.5	X
		8.0 [3]	B-103-8.0	X
B-104	Additional systematic soil samples	0.5 [2]	B-104-0.5	X
		1.5	B-104-1.5	X
		4.5	B-104-4.5	X
		8.0 [3]	B-104-8.0	X
B-105	Additional systematic soil samples	0.5 [2]	B-105-0.5	X
		1.5	B-105-1.5	X
		4.5	B-105-4.5	X
		8.0 [3]	B-105-8.0	X
B-106	Additional systematic soil samples	0.5 [2]	B-106-0.5	X
		1.5	B-106-1.5	X
		4.5	B-106-4.5	X
		8.0 [3]	B-106-8.0	X
B-107	Additional systematic soil samples	0.5 [2]	B-107-0.5	X
		1.5	B-107-1.5	X
		4.5	B-107-4.5	X
		8.0 [3]	B-107-8.0	X

TABLE 4

SOIL SAMPLING AND ANALYSIS PROGRAM SUMMARY [1]

Tyco Thermal Controls
2201 Bay Road
Redwood City, California

Sampling Location [1]	Rationale	Sample Depths (feet btof)	Sample Name	PCBs
B-108	Additional systematic soil samples	0.5 [2]	B-108-0.5	X
		1.5	B-108-1.5	X
		4.5	B-108-4.5	X
		8.0 [3]	B-108-8.0	X
B-109	Additional systematic soil samples	0.5 [2]	B-109-0.5	X
		1.5	B-109-1.5	X
		4.5	B-109-4.5	X
		8.0 [3]	B-109-8.0	X
B-110	Additional systematic soil samples	0.5 [2]	B-110-0.5	X
		1.5	B-110-1.5	X
		4.5	B-110-4.5	X
		8.0 [3]	B-110-8.0	X
Additional Assessment				
B-111	Additional assessment soil samples	0.5 [2]	B-111-0.5	X
		1.5	B-111-1.5	X
		4.5	B-111-4.5	X
		8.0 [3]	B-111-8.0	X

Analysis

Samples will be analyzed for PCBs using EPA Method 8082 following extraction using EPA Method 3550C (ultrasonic extraction method).

Notes

1. Sample locations are shown on Figure 2.
2. Sample will be collected directly beneath the concrete floor.
3. Sample will be collected at either 8.0 feet bgs or directly above first-encountered groundwater, which ever is shallowest.

Abbreviations

btof = below top of concrete floor
PCBs = polychlorinated biphenyls

[illegible]

TABLE 5

CONCRETE SAMPLING AND ANALYSIS PROGRAM SUMMARY [1]

Tyco Thermal Controls
2201 Bay Road
Redwood City, California

Sampling Location [1]	Rationale	Sample Depths (inches btof)	Sample Name	PCBs
A,1	Characterize concrete for waste disposal purposes	0.5	A,1-0.5	X
B,1	Characterize concrete for waste disposal purposes	0.5	B,1-0.5	X
C,1	Characterize concrete for waste disposal purposes	0.5	C,1-0.5	X
D,1	Characterize concrete for waste disposal purposes	0.5	D,1-0.5	X
E,1	Characterize concrete for waste disposal purposes	0.5	E,1-0.5	X
F,1	Characterize concrete for waste disposal purposes	0.5	F,1-0.5	X
G,1	Characterize concrete for waste disposal purposes	0.5	G,1-0.5	X
H,1	Characterize concrete for waste disposal purposes	0.5	H,1-0.5	X
I,1	Characterize concrete for waste disposal purposes	0.5	I,1-0.5	X
J,1	Characterize concrete for waste disposal purposes	0.5	J,1-0.5	X
K,1	Characterize concrete for waste disposal purposes	0.5	K,1-0.5	X
L,1	Characterize concrete for waste disposal purposes	0.5	L,1-0.5	X
M,1	Characterize concrete for waste disposal purposes	0.5	M,1-0.5	X
N,1	Characterize concrete for waste disposal purposes	0.5	N,1-0.5	X
O,1	Characterize concrete for waste disposal purposes	0.5	O,1-0.5	X
P,1	Characterize concrete for waste disposal purposes	0.5	P,1-0.5	X
A,2	Characterize concrete for waste disposal purposes	0.5	A,2-0.5	X
B,2	Characterize concrete for waste disposal purposes	0.5	B,2-0.5	X

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TABLE 5

CONCRETE SAMPLING AND ANALYSIS PROGRAM SUMMARY [1]

Tyco Thermal Controls
2201 Bay Road
Redwood City, California

Sampling Location [1]	Rationale	Sample Depths (inches btof)	Sample Name	PCBs
F,3	Characterize concrete for waste disposal purposes	0.5	F,3-0.5	X
G,3	Characterize concrete for waste disposal purposes	0.5	G,3-0.5	X
H,3	Characterize concrete for waste disposal purposes	0.5	H,3-0.5	X
I,3	Characterize concrete for waste disposal purposes	0.5	I,3-0.5	X
J,3	Characterize concrete for waste disposal purposes	0.5	J,3-0.5	X
K,3	Characterize concrete for waste disposal purposes	0.5	K,3-0.5	X
L,3	Characterize concrete for waste disposal purposes	0.5	L,3-0.5	X
M,3	Characterize concrete for waste disposal purposes	0.5	M,3-0.5	X
N,3	Characterize concrete for waste disposal purposes	0.5	N,3-0.5	X
O,3	Characterize concrete for waste disposal purposes	0.5	O,3-0.5	X
P,3	Characterize concrete for waste disposal purposes	0.5	P,3-0.5	X
F,4	Characterize concrete for waste disposal purposes	0.5	F,4-0.5	X
G,4	Characterize concrete for waste disposal purposes	0.5	G,4-0.5	X
H,4	Characterize concrete for waste disposal purposes	0.5	H,4-0.5	X
I,4	Characterize concrete for waste disposal purposes	0.5	I,4-0.5	X
J,4	Characterize concrete for waste disposal purposes	0.5	J,4-0.5	X
K,4	Characterize concrete for waste disposal purposes	0.5	K,4-0.5	X
L,4	Characterize concrete for waste disposal purposes	0.5	L,4-0.5	X

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TABLE 5

CONCRETE SAMPLING AND ANALYSIS PROGRAM SUMMARY [1]

Tyco Thermal Controls
2201 Bay Road
Redwood City, California

Sampling Location [1]	Rationale	Sample Depths (inches btof)	Sample Name	PCBs
M,4	Characterize concrete for waste disposal purposes	0.5	M,4-0.5	X
E,5	Characterize concrete for waste disposal purposes	0.5	E,5-0.5	X
F,5	Characterize concrete for waste disposal purposes	0.5	F,5-0.5	X
G,5	Characterize concrete for waste disposal purposes	0.5	G,5-0.5	X
H,5	Characterize concrete for waste disposal purposes	0.5	H,5-0.5	X
I,5	Characterize concrete for waste disposal purposes	0.5	I,5-0.5	X
J,5	Characterize concrete for waste disposal purposes	0.5	J,5-0.5	X
K,5	Characterize concrete for waste disposal purposes	0.5	K,5-0.5	X
L,5	Characterize concrete for waste disposal purposes	0.5	L,5-0.5	X
M,5	Characterize concrete for waste disposal purposes	0.5	M,5-0.5	X
I,6	Characterize concrete for waste disposal purposes	0.5	I,6-0.5	X
J,6	Characterize concrete for waste disposal purposes	0.5	J,6-0.5	X
K,6	Characterize concrete for waste disposal purposes	0.5	K,6-0.5	X
L,6	Characterize concrete for waste disposal purposes	0.5	L,6-0.5	X
M,6	Characterize concrete for waste disposal purposes	0.5	M,6-0.5	X
I,7	Characterize concrete for waste disposal purposes	0.5	I,7-0.5	X
J,7	Characterize concrete for waste disposal purposes	0.5	J,7-0.5	X
K,7	Characterize concrete for waste disposal purposes	0.5	K,7-0.5	X

TABLE 5

CONCRETE SAMPLING AND ANALYSIS PROGRAM SUMMARY [1]

Tyco Thermal Controls
2201 Bay Road
Redwood City, California

Sampling Location [1]	Rationale	Sample Depths (inches btof)	Sample Name	PCBs
L,7	Characterize concrete for waste disposal purposes	0.5	L,7-0.5	X
M,7	Characterize concrete for waste disposal purposes	0.5	M,7-0.5	X
I,8	Characterize concrete for waste disposal purposes	0.5	I,8-0.5	X
J,8	Characterize concrete for waste disposal purposes	0.5	J,8-0.5	X
K,8	Characterize concrete for waste disposal purposes	0.5	K,8-0.5	X
L,8	Characterize concrete for waste disposal purposes	0.5	L,8-0.5	X
M,8	Characterize concrete for waste disposal purposes	0.5	M,8-0.5	X
M,9	Characterize concrete for waste disposal purposes	0.5	M,9-0.5	X

Analysis

Samples will be analyzed for PCBs using U.S. EPA Method 8082 following extraction using U.S. EPA Method 3550C (ultrasonic extraction method).

Notes

1. Sample locations are shown on Figure 3.

Abbreviations

btof = below top of concrete floor
PCBs = polychlorinated biphenyls

TABLE 6

CLEANUP VERIFICATION SOIL SAMPLING AND ANALYSIS PROGRAM SUMMARY [1]

Tyco Thermal Controls
2201 Bay Road
Redwood City, California

Composite Sample ID	Number of Discrete Samples to be Composited	Rationale	Discrete Sample Depths (feet bgs)	PCBs	Dioxin-Like PCB Congeners
Excavation 1A					
EX1A-SC-1	5	Sidewall Cleanup Verification	1.0	X	
EX1A-SC-2	4	Sidewall Cleanup Verification	1.0	X	
EX1A-SC-3	9	Sidewall Cleanup Verification	1.0	X	X
EX1A-SC-4	9	Sidewall Cleanup Verification	1.0	X	
EX1A-SC-5	3	Sidewall Cleanup Verification	1.0	X	
EX1A-SC-6	4	Sidewall Cleanup Verification	1.0	X	
EX1A-SC-7	8	Sidewall Cleanup Verification	1.0	X	X
EX1A-SC-8	6	Sidewall Cleanup Verification	1.0	X	
EX1A-SC-9	9	Sidewall Cleanup Verification	1.0	X	
EX1A-SC-10	2	Sidewall Cleanup Verification	1.0	X	
EX1A-BC-1	4	Bottom Cleanup Verification	2.0	X	
EX1A-BC-2	5	Bottom Cleanup Verification	2.0	X	
EX1A-BC-3	6	Bottom Cleanup Verification	2.0	X	
EX1A-BC-4	9	Bottom Cleanup Verification	2.0	X	X
EX1A-BC-5	9	Bottom Cleanup Verification	2.0	X	
EX1A-BC-6	9	Bottom Cleanup Verification	2.0	X	
EX1A-BC-7	9	Bottom Cleanup Verification	2.0	X	
EX1A-BC-8	8	Bottom Cleanup Verification	2.0	X	
EX1A-BC-9	9	Bottom Cleanup Verification	2.0	X	
Excavation 1B					
EX1B-SC-1	3	Sidewall Cleanup Verification	4.0	X	
EX1B-SC-2	8	Sidewall Cleanup Verification	4.0	X	
EX1B-SC-3	8	Sidewall Cleanup Verification	4.0	X	
EX1B-SC-4	2	Sidewall Cleanup Verification	4.0	X	X
EX1B-SC-5	8	Sidewall Cleanup Verification	4.0	X	
EX1B-SC-6	8	Sidewall Cleanup Verification	6.0	X	
EX1B-SC-7	8	Sidewall Cleanup Verification	6.0	X	
EX1A-BC-1	4	Bottom Cleanup Verification	8.0	X	
EX1A-BC-2	9	Bottom Cleanup Verification	8.0	X	X
EX1A-BC-3	9	Bottom Cleanup Verification	8.0	X	
EX1A-BC-4	6	Bottom Cleanup Verification	8.0	X	
EX1A-BC-5	6	Bottom Cleanup Verification	8.0	X	
EX1A-BC-6	8	Bottom Cleanup Verification	8.0	X	
EX1A-BC-7	5	Bottom Cleanup Verification	8.0	X	
EX1A-BC-8	4	Bottom Cleanup Verification	8.0	X	

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TABLE 6

CLEANUP VERIFICATION SOIL SAMPLING AND ANALYSIS PROGRAM SUMMARY [1]

Tyco Thermal Controls
2201 Bay Road
Redwood City, California

Composite Sample ID	Number of Discrete Samples to be Composited	Rationale	Discrete Sample Depths (feet bgs)	PCBs	Dioxin-Like PCB Congeners
EX2A-BC-26	9	Bottom Cleanup Verification	5.0	X	
EX2A-BC-27	9	Bottom Cleanup Verification	5.0	X	
EX2A-BC-28	9	Bottom Cleanup Verification	5.0	X	
EX2A-BC-29	9	Bottom Cleanup Verification	5.0	X	X
EX2A-BC-30	9	Bottom Cleanup Verification	5.0	X	
EX2A-BC-31	9	Bottom Cleanup Verification	5.0	X	
Excavation 2B					
EX2B-SC-1	3	Sidewall Cleanup Verification	4.0	X	
EX2B-SC-2	5	Sidewall Cleanup Verification	4.0	X	X
EX2B-SC-3	6	Sidewall Cleanup Verification	4.0	X	
EX2B-SC-4	5	Sidewall Cleanup Verification	4.0	X	
EX2B-BG-1	9	Bottom Cleanup Verification	8.0	X	
EX2B-BG-2	9	Bottom Cleanup Verification	8.0	X	
EX2B-BG-3	6	Bottom Cleanup Verification	8.0	X	
EX2B-BG-4	6	Bottom Cleanup Verification	8.0	X	
EX2B-BG-5	9	Bottom Cleanup Verification	8.0	X	
EX2B-BG-6	9	Bottom Cleanup Verification	8.0	X	X
EX2B-BG-7	9	Bottom Cleanup Verification	8.0	X	
EX2B-BG-8	9	Bottom Cleanup Verification	8.0	X	
Excavation 2C					
EX2C-SC-1	8	Sidewall Cleanup Verification	1.0	X	
EX2C-SC-2	4	Sidewall Cleanup Verification	1.0	X	
EX2C-SC-3	8	Sidewall Cleanup Verification	1.0	X	
EX2C-SC-4	4	Sidewall Cleanup Verification	1.0	X	X
EX2C-SC-5	4	Sidewall Cleanup Verification	1.0	X	
EX2C-SC-6	4	Sidewall Cleanup Verification	1.0	X	
EX2C-SC-7	4	Sidewall Cleanup Verification	1.0	X	
EX2C-BC-1	6	Bottom Cleanup Verification	2.0	X	
EX2C-BC-2	6	Bottom Cleanup Verification	2.0	X	
EX2C-BC-3	8	Bottom Cleanup Verification	2.0	X	
EX2C-BC-4	9	Bottom Cleanup Verification	2.0	X	
EX2C-BC-5	9	Bottom Cleanup Verification	2.0	X	X
EX2C-BC-6	8	Bottom Cleanup Verification	2.0	X	
EX2C-BC-7	8	Bottom Cleanup Verification	2.0	X	
Excavation 3A					
EX3A-SC-1	8	Sidewall Cleanup Verification	1.5	X	X
EX3A-SC-2	6	Sidewall Cleanup Verification	1.5	X	
EX3A-SC-3	8	Sidewall Cleanup Verification	1.5	X	
EX3A-SC-4	6	Sidewall Cleanup Verification	1.5	X	
EX3A-BC-1	9	Bottom Cleanup Verification	3.0	X	

TABLE 6

CLEANUP VERIFICATION SOIL SAMPLING AND ANALYSIS PROGRAM SUMMARY [1]

Tyco Thermal Controls
2201 Bay Road
Redwood City, California

Composite Sample ID	Number of Discrete Samples to be Composited	Rationale	Discrete Sample Depths (feet bgs)	PCBs	Dioxin-Like PCB Congeners
EX3A-BC-2	9	Bottom Cleanup Verification	3.0	X	
EX3A-BC-3	6	Bottom Cleanup Verification	3.0	X	X
EX3A-BC-4	9	Bottom Cleanup Verification	3.0	X	
EX3A-BC-5	9	Bottom Cleanup Verification	3.0	X	
EX3A-BC-6	6	Bottom Cleanup Verification	3.0	X	

Analysis

Samples will be analyzed for PCBs using EPA Method 8082 following extraction using EPA Method 3550C (ultrasonic extraction method) and dioxin-like PCB congeners using EPA Method 1668.

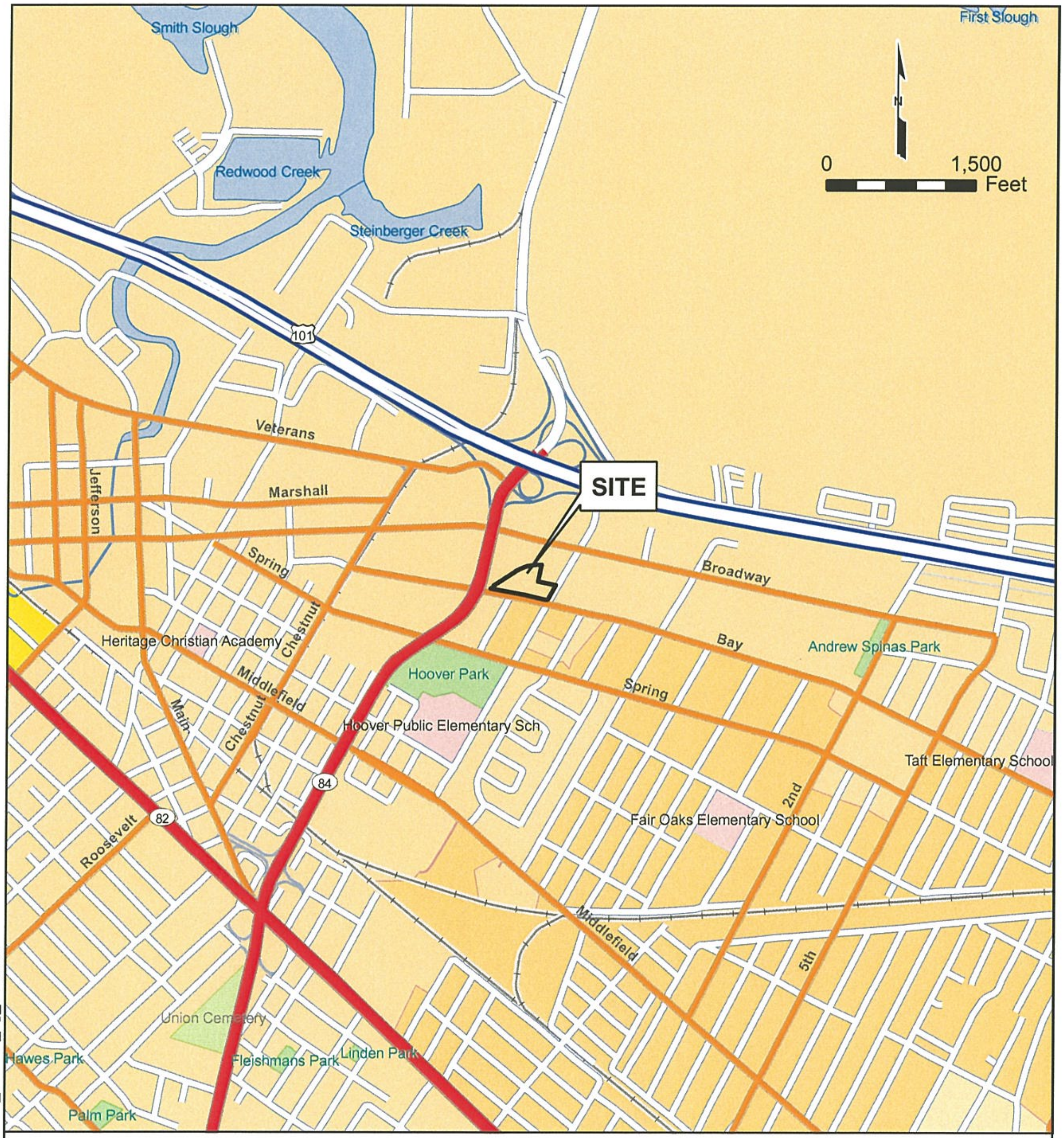
Notes

1. Sample locations are shown on Figures 5 through 8.

Abbreviations

btof = below top of concrete floor
PCBs = polychlorinated biphenyls

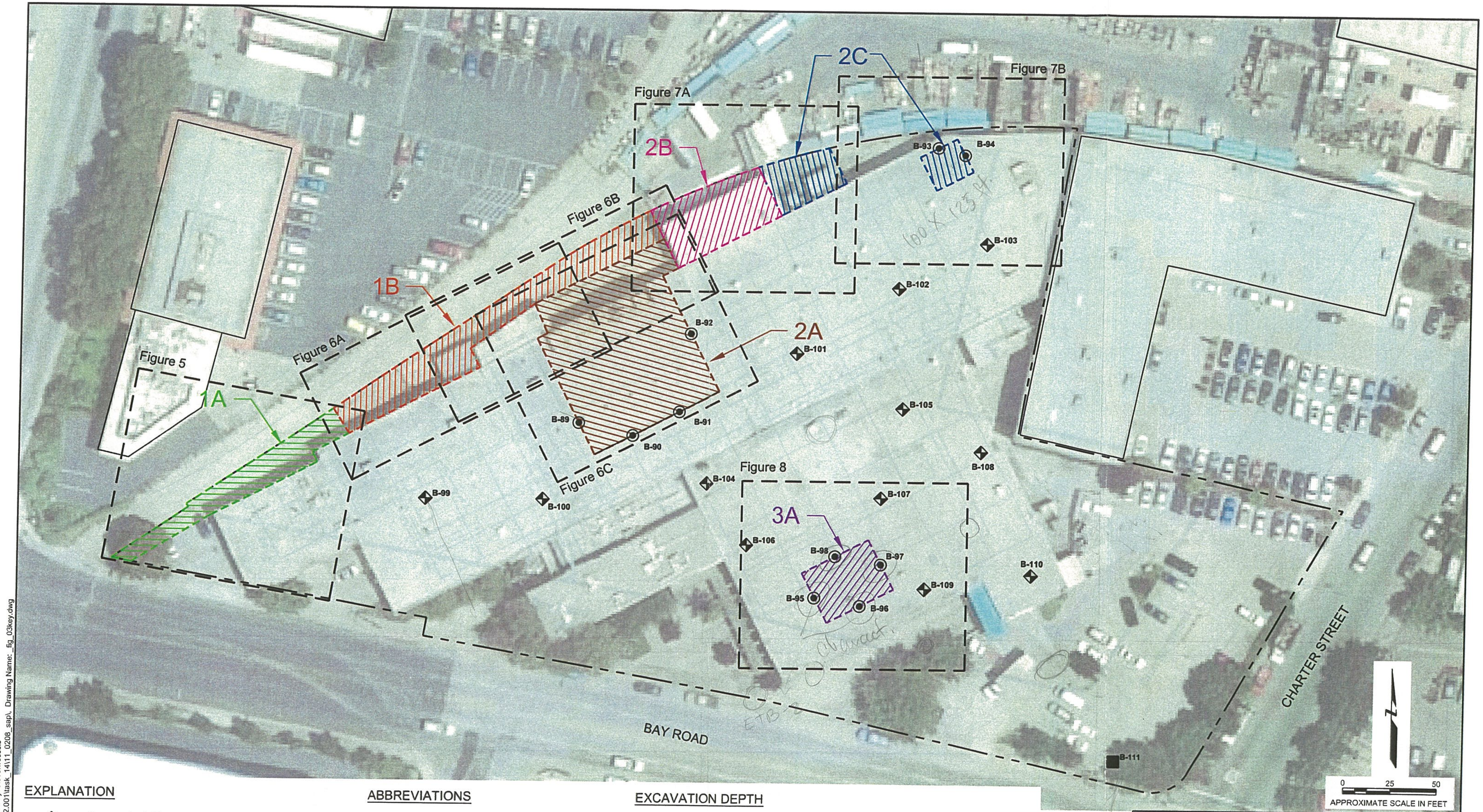
FIGURES



SITE LOCATION MAP
Tyco Thermal Controls
2201 Bay Road
Redwood City, California

By: MKP	Date: 5/21/2009	Project No. 12442.001
AMEC Geomatrix		Figure 1

File path: S:\12400\12442\12442.001\task_11\10_0520_RDRA_fig_01.mxd



EXPLANATION

- Proposed additional systematic soil sample location
- Proposed additional soil assessment sample location
- Proposed confirmation soil sample location
- Property line

ABBREVIATIONS

BGS = Below Ground Surface

ESL = Environmental Screening Level

PCB = Polychlorinated Biphenyls

EXCAVATION DEPTH

- Excavation area 1A = 2' BGS
- Excavation area 1B = 8' BGS
- Excavation area 2A = 5' BGS
- Excavation area 2B = 8' BGS
- Excavation area2C = 2' BGS
- Excavation area 3A = 3' BGS

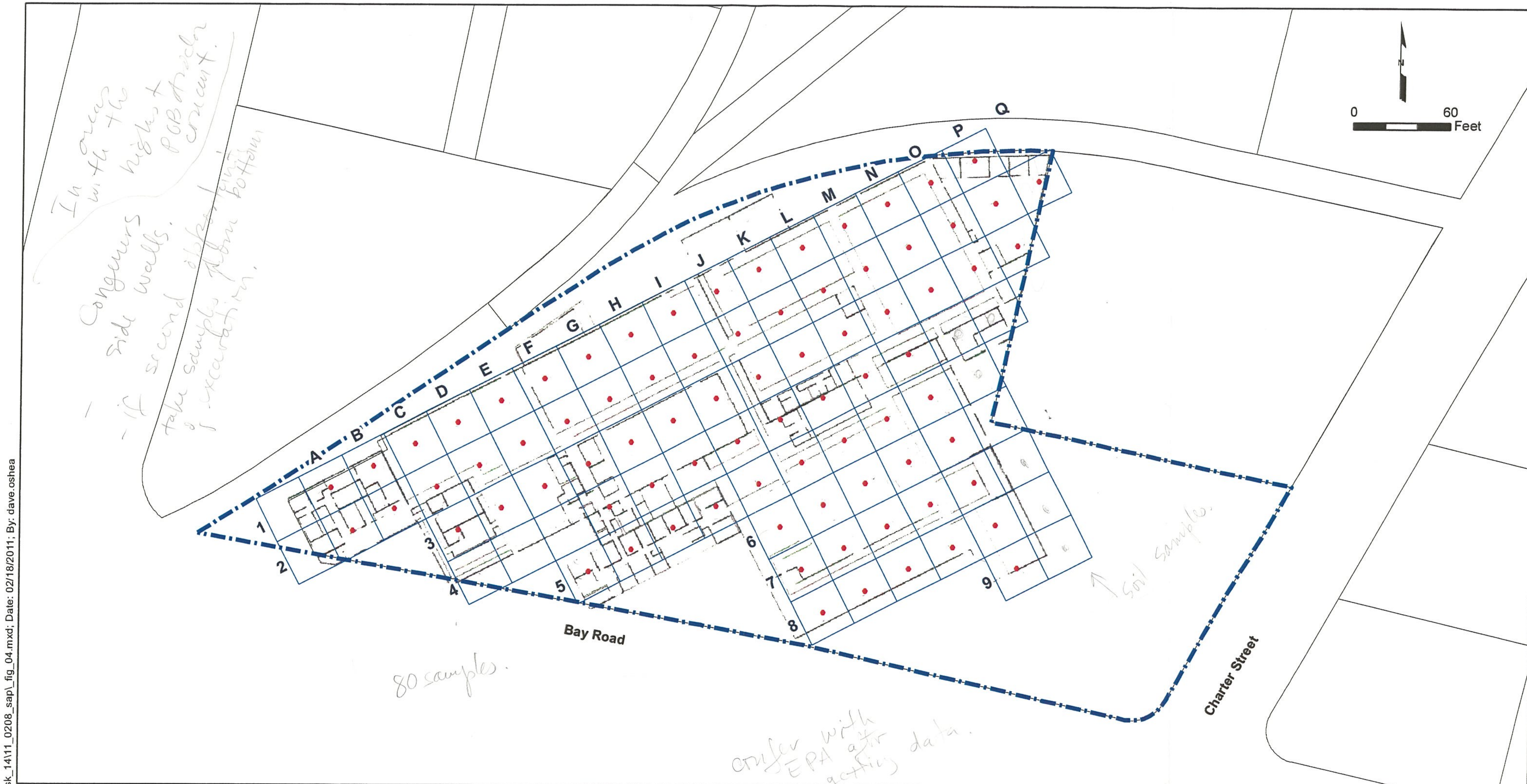
West
East

ETB-1

SOIL EXCAVATION PLAN AND
PROPOSED SOIL SAMPLING LOCATIONS
Tyco Thermal Controls
2201 Bay Road
Redwood City, California

By: JMS	Date: 02/18/11	Project No. 12442.001
AMEC Geomatrix		Figure 3

Plot Date: 02/18/11 - 12:03pm, Plotted by: steve.wessels
Drawing Path: S:\12400\12442\12442.001\task_14\11_0208_sap\, Drawing Name: fig_03key.dwg



Explanation

- Proposed concrete slab sample location
- 9 meter by 9 meter grid 30' x 30'
- Site boundary (approximate)

PROPOSED CONCRETE FLOOR SAMPLING LOCATIONS
Tyco Thermal Controls
2201 Bay Road
Redwood City, California

By: JMS	Date: 02/18/2011	Project No. 12442.001

AMEC Geomatrix — Figure 4

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APPENDICES

Included on CD

(see CD[1])

[1] To download Acrobat Reader, go to http://www.adobe.com/ and click on "Get Adobe Reader."

APPENDIX D (REVISED)
REVIEW OF SOIL SAMPLING PROGRAM FOR PCBs

Tyco Thermal Controls
2201 Bay Road
Redwood City, California

This appendix describes a review of the previous soil sampling programs for polychlorinated biphenyls (PCBs) at the former Tyco Thermal Controls, Inc. (TTC), facility located at 2201 Bay Road, Redwood City, California (the site) and, based on our review and statistical analysis, a proposal to collect additional soil samples to address comments from U.S. Environmental Protection Agency (EPA) at a meeting on May 11, 2010.

Soil samples were collected at the site and analyzed for PCBs in four separate investigations in May 1999, March 2005, June 2008, and January 2010. Previous sample locations were selected based on both an authoritative (i.e., locations were selected to target site features) and systematic (i.e., locations selected based on a rectangular grid) sampling approach. A total of 406 soil samples have been collected from 119 separate soil borings located inside and outside the building footprint at depths ranging for 0.5 to 8 feet beneath ground surface (bgs). For convenience, measurements of depth below the surface of the interior floor or concrete slab will also be referred to as feet bgs.

The purpose of this evaluation is to determine if sufficient samples have been collected to characterize constituents of potential concern (COPCs) that may be detected in soil beneath the building footprint based on EPA recommendations and guidelines. First, an overview of the soil sampling program is presented. Second, the number of soil samples needed to characterize potential detections of COPCs in subsurface soil based on statistical procedures and confidence levels is calculated. Third, sample spacing throughout the building footprint is evaluated, and recommendations regarding the collection of additional soil samples are presented.

OVERVIEW OF SOIL SAMPLING PROGRAM

This section presents an overview of the previous soil sampling programs for PCBs at the site. Analytical results for soil samples analyzed for PCBs in each investigation are presented in Appendix A.

In 1999, soil samples were predominately collected from locations along the northwestern portion of the site near a loading dock adjacent to the building. In 2005, the sampling program from 1999 was augmented by collecting soil samples below the footprint of the building in an area of the building along the northwestern portion of the Site. A sample grid was used to systematically select sample locations; some of which were adjusted to address site features, such as cracks or patches in the concrete floor, that were indicative of possible pathways to sub-surface soil.

During the 1999 and 2005 site investigations, 62 soil samples were collected from 32 borings to a maximum depth of 8 feet bgs (the approximate depth to groundwater). Typical sample depths for individual borings were 0 and 2 feet bgs; 0, 2, and 6 feet bgs; or 0, 1, 2, and 8 feet bgs. The sample depths are included in the summary tables in Appendix A.

In June 2008, an additional 53 soil samples were collected from 14 borings and analyzed for PCBs in soil in three areas of the Site outside of the building footprint: a) near the loading ramp and platform where elevated concentrations of PCBs were detected, but the vertical extent was not defined; b) near the former aboveground storage tanks (ASTs); and c) an area where a former water tank was reportedly located inside the building.

Because there is no history of operations or knowledge where PCBs were used in the building, an additional 291 sub-slab soil samples were collected from 73 soil borings and analyzed for PCBs in January 2010. The 2010 investigation was also designed to define the lateral and vertical extent of PCBs near the northwestern edge of the building footprint. The sample locations near the northwestern edge of the building footprint were placed on a systematic, triangular grid based on 15-foot spacing (Figure D-1). For the rest of the building, soil samples were placed on a systematic square grid based on approximate 60-foot spacing and then adjusted target site features.

In summary, a total of 406 soil samples from 119 separate soil borings advanced to depths up to 8 feet bgs have been collected outside and from within the building footprint using elements of both an authoritative and systematic sampling approach. Most of the boring locations were initially selected based on a systematic sampling approach. However, sample locations were adjusted from the initial grid locations to target site features, such as cracks or patches observed in the concrete slab. For the January 2010 investigation, the sampling locations were adjusted in cooperation with a representative of the Regional Water Quality Control Board – San Francisco Region, who was present when the adjustments were made. Table D-1 presents a summary of soil samples collected at the Site and analyzed for PCBs.

Table D-1. Summary of soil samples analyzed for PCBs by depth.

Sample Depth (feet bgs)	Number of Samples	
	Total Collected at the Site	Total Collected within the Building Footprint
<1	39	20
1 to <2	77	64
2 to <4	101	73
4 to <6	88	76
6 to 8	101	77
Total	406	310

DETERMINATION OF SAMPLE SIZE

This section presents the statistical procedure used to determine the number of sub-slab soil samples necessary to conclude, with a 95 percent (%) confidence level, that the area that could contain COPCs has been properly characterized in conformance with the applicable cleanup level. The number of samples needed to characterize whether soil beneath the building footprint contains COPCs was calculated using a method prescribed by EPA (1989). Specifically, the sample size requirement was calculated based on a confidence of 95% (α = 0.05) that less than 5% (P_0 = 0.05) of the soil beneath the building footprint exceeded the cleanup standard of 0.74 milligrams per kilogram (mg/kg):

$$n_d = \left(\frac{Z_{(1-\beta)} \times \sqrt{P_1 \times (1-P_1)} + Z_{(1-\alpha)} \times \sqrt{P_0 \times (1-P_0)}}{P_0 - P_1} \right)^2$$

Where	n_d	Derived sample size
	α	False positive rate (0.05 percent)
	β	False negative rate (0.20 percent)
	$z_{1-\alpha}$	Critical value for a normal distribution with probably of α (1.645)
	$z_{1-\beta}$	Critical value for a normal distribution with probably of β (0.842)
	P_1	Value of P under the alternative hypothesis (0.01) (i.e., probability for the specified false negative rate)
	P_0	Percent of sub-surface soil that may exceed the cleanup standard (0.05)

Using this formula, a sample size of 123 was derived. The number of samples collected at various depths throughout the footprint of the building (310) is more than twice as many needed based on EPA's statistical procedure (EPA, 1989). Therefore, using the assumptions noted above, the number of samples collected is adequate for characterizing the soil beneath the building slab.

LOCATING AREAS OF HIGHER COPC CONCENTRATIONS

Systematic sampling programs are designed to locate an area or volume of soil of a certain size that could hypothetically have higher concentrations of COPCs. The hypothetical location is relatively small compared to the area being sampled. As the size of a sampling grid is decreased, the size of this hypothetical location that could potentially be missed by the sampling program also decreases. The probability of locating a circular location of higher COPC concentrations can be estimated by power curves that relate grid spacing and shape of the hypothetical area (Gilbert, 1987). The evaluation below addresses two general areas of the site. The first is the area along the northwestern edge of the building where soil borings were located on a 15-foot triangular grid. The second is the remaining portion of the building footprint where soil borings were initially located at a 60-foot grid and then adjusted based on observations in the field regarding site features.

Along the northwestern edge of the building, soil borings were located at the centers of a 15-foot triangular grid (northwest area, Figure D-2). The probability of locating a circular, hypothetical area of higher COPCs is estimated by power curves that relate grid spacing and shape to the size and shape of targeted areas (Gilbert, 1987):

$$\beta = L / G$$

Where	β	Consumer's risk (i.e., probability of not location a hypothetical area of higher COPCs)
	L	Length of semimajor axis for a hypothetical area of higher COPCs (i.e., radius of circular, hypothetical area)
	G	Sample grid spacing

Using the power curves presented in Gilbert for a triangular sampling grid and a circular hypothetical area of higher COPCs (S equal to 1.0 on the power curve, Figure D-3), the L/G ratio is approximately 0.5 at a consumer's risk (β) of 0.05. Therefore, with a 95% probability, a circular location of higher COPC concentrations 7.5 feet in diameter would be detected along the northwestern portion of the site.

Throughout the rest of the building, soil borings were initially placed at a 60-foot grid and then adjusted based on observations in the field regarding site features. For this evaluation, 12 additional locations were added to develop an overall triangular sampling grid with spacing between sampling points ranging between 20 and 30 feet (Figure D-2). The evaluation also

A-23 GW ← PCBs in ET9 → 65 (1254); 46 (1260) 3/10/2005 // ET-1 3/10/2005; 67 (1254) mg/L

includes the 10 locations selected for confirmation sampling for the three soil excavation areas. As described previously, the L/G ratio is approximately 0.5 for a triangular sampling grid with a consumer's risk (β) of 0.05 and a circular, hypothetical area of higher COPC concentration. With the existing borings and the 22 additional borings, the Gilbert power curves result in a 95% probability that a circular location of higher COPC concentrations approximately 10 to 15 feet in diameter would be detected.

CONCLUSIONS AND RECOMMENDATIONS

The following conclusions are based on the evaluation presented in this appendix:

- The number of samples collected at various depths throughout the footprint of the building (310) is more than twice as many needed based on EPA's statistical procedure. Therefore, the number of samples collected is adequate for characterizing the site.

- Although a sufficient number of samples have been collected at the site, the spacing between samples was not consistent throughout the building footprint. Additional soil samples are proposed at 12 locations to confirm with a 95% probability that a hypothetical circular location of higher COPC concentrations of approximately 10 to 15 feet would not be missed.

The following recommendations will be incorporated into the remediation work for the site:

- Prior to beginning soil excavation, 22 soil borings will be located as shown on Figure D-2. The soil borings will be located to confirm the delineation of soil excavations (10 borings) and to decrease overall sample spacing (12 borings). Four soil samples will be collected from each soil boring, for a total of 88 samples, and analyzed for PCBs by Method 8082. The results will be evaluated to identify any additional areas to be considered for excavation.

- The results of the concrete sampling program described in Appendix E may be used to supplement the proposed soil sampling program.

- During the removal of the concrete slab, the underlying soil will be observed for evidence of staining or odors; and, based on these observations, additional soil sampling may be proposed to evaluate soil conditions.

GW at 6.5 to 9.1 ft bgs. GW flow to northwest, toward SFB.

REFERENCES

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U.S. Environmental Protection Agency (EPA), 1989, Methods for Evaluating the Attainment of Cleanup Standards, Volume 1. Soils and Solid Media, EPA 230/02-89-042, February.